Name: ______________________________ Date: ______________

SKILL and PRACTICE 1.1

Using Your Textbook

Your textbook is a tool to help you understand and enjoy science. Colors, shapes, and symbols are used in the book to help you find information quickly. Take a few minutes to get familiar with these features—it will help you get the most out of your book all year long.

PRACTICE

Part 1: The Introduction

Take a look at the introduction found at the beginning of your textbook. These pages are easy to find because they have a light blue background. Use these pages and the rest of your book to answer the questions below.

1. What color is used to identify Unit 5?
2. List two important vocabulary words for section 5.2.
3. What color are the boxes in which you found these vocabulary words?
4. What is the main idea of the first paragraph on page 24?
5. Where do you find section review questions?
6. What is the first key question for chapter 9?
7. List the four sections found in each Chapter Assessment.

Part 2: The Table of Contents

The Table of Contents is found after the introduction pages. Use it to answer the following questions.

1. How many units are in the textbook? List their titles.
2. Which unit will be the most interesting to you? Why?
3. At the end of each chapter is a two-page article called a “Connection” which describes an interesting application of topics in the chapter. Look at all the Connection titles and list the three that interest you most.
4. What is on the page after each Connection?

Part 3: Tools at the end of the text

At the back of the book, you will find tools to help you use the text. Use these tools to answer the questions.

1. What is the name for the section of the book that lists definitions of words?
2. What is the definition for magma?
3. What is the first page in the text that contains information on the scientific method?
4. On what page will you find information on divergent boundaries?

Name: ______________________ Date: ______________

SKILL and PRACTICE 1.1

What's Your Hypothesis?

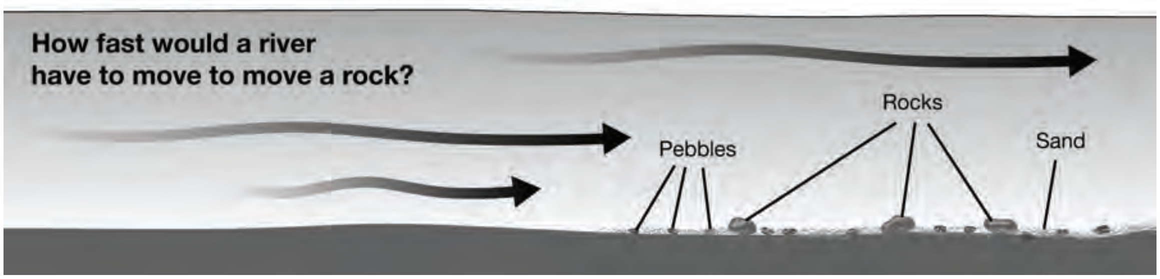
READ

After making observations, a scientist forms a question based on observations and then attempts to answer that question. A guess or a possible answer to a scientific question based on observations is called a **hypothesis**. It is important to remember that a hypothesis is not always correct. A hypothesis must be testable so that you can determine whether or not it is correct.

EXAMPLE

In science class your teacher has told you that the ability of a river to transport material depends on how fast the river is flowing. Imagine the river has three speeds—slow, medium, and fast. Now, imagine the river bottom has sand, marble-sized pebbles, and baseball-sized rocks. Come up with a hypothesis for the answer to the following question. Then, justify your reasoning:

Research question: At which flow rate—slow, medium, or fast—would a river be able to transport baseball-sized rock?



Example hypothesis and justification: The river would have to be flowing at a fast flow rate to be able to transport baseball-sized rocks. It takes more force to move larger rocks than small pebbles and sand. Fast flowing water has more pushing force than medium or slow flowing water. I know this from an experience I had wading in a river one time. As I waded from still water to areas where the river was flowing faster, I could feel the water pushing against my legs more and more.

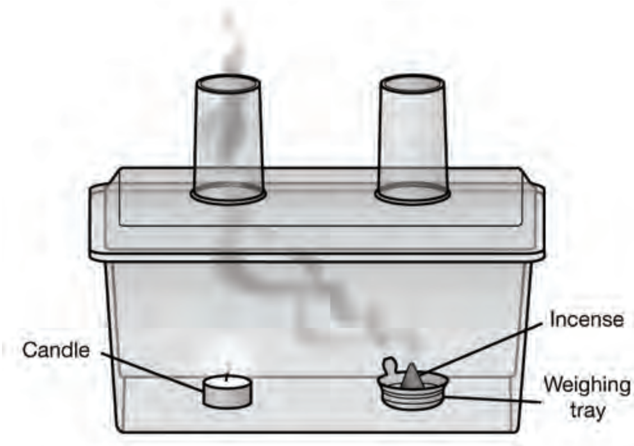
PRACTICE

1. You left a glass full of water by a window in your house in the morning. Three hours later you walk by the glass, and the water level is noticeably lower than it was in the morning. You have made the observation that the water level in the cup is lower. Then, you ask the following question: "Why is the water level in the cup lower?"

   What is a possible hypothesis you could make?

2. Your teacher shows you a demonstration in which there is a box with two chimneys. Under one chimney is a lit candle, and under the other chimney is smoke from burning incense. You observe that the smoke always goes towards the candle and then exits the box from the chimney above the candle. You ask the following question: "Why does the smoke go toward the candle and leave the chimney above the candle?"

   What is a possible hypothesis you could make?



3. You have learned in science class that *evaporation* is a process that describes when a liquid turns to a gas at a temperature below the boiling point. You are now about to investigate evaporation and factors that may increase the rate at which it occurs. You ask the question, "What causes the evaporation rate of water to increase?"

   What is a possible hypothesis you could make?

4. Rivers and streams flow at various speeds. You ask, "What factors increase the flow rate of a river?"

   What is a possible hypothesis you could make?

5. It is late fall and you notice that flower bulbs in your yard have been dug up and some have been eaten. You ask, "What has happened?"

   What is a possible hypothesis you could make?

6. You know that sea otters eat sea urchins and that sea urchins eat kelp. You ask, "What would happen to this ecosystem if all the kelp died?"

   What is a possible hypothesis you could make?

7. In Alaska, lynx (wild cats) are predators of the snowshoe hare. In the wintertime, the coat of the snowshoe hare turns from brown to white. You ask, "Why does the snoeshoe hare change color in the winter?"

   What is a possible hypothesis you could make?

8. In the deserts of the southwestern United States, coyotes are dog-like animals that eat many different things such as small animals and cactus fruit. They are also scavengers, which means they eat dead and decaying animals. You ask, "Are there coyote-like animals that serve as predator-scavengers in other deserts on other continents?"

   What is a possible hypothesis you could make?

Name: ______________________ Date: ______________

SKILL and PRACTICE 1.2

Averaging

READ

The most common type of average is called the *mean*. Usually when someone (who's not your math teacher) asks you to find the average of something, it is the *mean* that they want. To find the mean, just sum (add) all the data, then divide the total by the number of items in the data set. This type of average is used daily by many people. Teachers and students use it to average grades. Meteorologists use it to average normal high and low temperatures for a certain date. Sports statisticians use it to calculate batting averages and many other things.

EXAMPLE

- William has had three tests so far in his English class. His grades are 80%, 75%, and 90%. What is his average test grade?

  Solution:

  a. Find the sum of the data: 80 + 75 + 90 = 245

  b. Divide the sum (245) by the number of items in the data set (3): 245 ÷ 3 ≈ 82%

  William's average (mean) test grade in English (so far) is about 82%

PRACTICE

1. The families on Carvel Street were cleaning out their basements and garages to prepare for their annual garage sale. At 202 Carvel Street, they found seven old baseball gloves. At 208, they found two baseball gloves. At 214, they found four gloves, and at 221 they found two gloves. If these are the only houses on the street, what is the average number of old baseball gloves found at a house on Carvel Street?

2. During a holiday gift exchange, the members of the winter play cast set a limit of $10 per gift. The actual prices of each gift purchased were: $8.50, $10.29, $4.45, $12.79, $6.99, $9.29, $5.97, and $8.33. What was the average price of the gifts?

3. During weekend baby sitting jobs, each sitter charged a different hourly rate. Rachel charged $4.00, Juanita charged $3.50, Michael charged $4.25, Rosa charged $5.00, and Smith charged $3.00.

   a. What was the average hourly rate charged among these baby sitters?

   b. If they each worked a total of eight hours, what was their average pay for the weekend?

4. The boys on the sixth grade basketball team at Fillmore Middle School scored 22 points, 12 points, 8 points, 4 points, 4 points, 3 points, 2 points, 2 points, and 1 point in Thursday's game. What was the average number of points scored by each player in the game?

5. Jerry and his friends were eating pizza together on a Friday night. Jerry ate a whole pizza (12 slices) by himself! Pat ate three slices, Jack ate seven slices, Don and Dave ate four slices each, and Teri ate just two slices. What was the average number of slices of pizza eaten by one of these friends that night?

Name: ______________________ Date: ______________

SKILL and PRACTICE 1.2

Stopwatch Math

READ

What do horse racing, competitive swimming, stock car racing, speed skating, many track and field events, and some scientific experiments have in common? It's the need for some sort of stopwatch, and people to interpret the data. For competitive athletes in speed-related sports, finishing times (and split times taken at various intervals of a race) are important to help the athletes gauge progress and identify weaknesses so they can adjust their training and improve.

EXAMPLE

Three boys ran the following times for 400 meters (one lap around the track) in their gym class: Joe ran 1:13.02 (1 minute, 13.02 seconds), Rocco ran 1:13.2 (1 minute, 13.2 seconds), and Eric ran 1:13 (1 minute, 13 seconds.) In what order did they finish?

The boy who came in first is the one with the fastest (smallest) time. Compare each time digit by digit, starting with the largest place-value (the largest place value is the one that is farthest to the left). Here, that would be the minutes place.

There is a "1" in the minutes' place of each time, so next, compare the seconds' place. Notice that the second's place in each case has a different number of digits. It is helpful to rewrite each one so that it has the same number of digits to the right of the decimal point. The table below shows the rewriting process and makes it easy to compare the times:

Name	Given Time	Rewritten Time	Finishing Place
Joe	1:13.02	1:13.02	
Rocco	1:13.2	1:13.20	
Eric	1:13	1:13.00	

Since Rocco's time has larger numbers in the seconds' place (13.20) than Joe (13.02) or Eric (13.00), his time is larger (slower) than the other two. We know Rocco finished third out of the three boys. Now, comparing Joe's time (13.02) to Eric's (13.00), notice that Joe's time is larger (slower) than Eric's (13.02 > 13.00). This means that Eric's time was fastest (smallest), so he finished first, followed by Joe. Rocco's time was the slowest (largest).

PRACTICE

1. Put each set of times in order from fastest to slowest. Use the tables to help you compare the times. After using the tables to help rank the times, rewrite them in order from fastest to slowest.

a. 5.07 0.507 0.57

Given time	Rewritten time	Rank
5.07		
0.507		
0.57		

b. 33.033 33.3 33.03 33 33.303

Given time	Rewritten time	Rank
33.033		
33.3		
33.03		
33		
33.303		

2. The table below gives the winners and their times from eight USA track and field championship races in the women's 800 meter run. Rewrite the table so that the times are in order from fastest to slowest. Please include the times and the years.

Year	2005	2004	2003	2002	2001	2000	1999	1998
Time	1:59.74	1:59.06	1:58.84	1:58.83	2:00.43	1:58.97	1:59.47	1:58.78
Name	Hazel Clark	Jearl Miles-Clark	Jearl Miles-Clark	Nicole Teter	Regin Jacobs	Hazel Clark	Jearl Miles-Clark	Jearl Miles-Clark

Time								
Year								

3. The following are times recorded during an experiment with rolling a ball down hill. Put them in order from fastest to slowest.

   a. 1:07.3   1:06   1:07.1   1:05.03   1:06.03   1:05.3   1:07.05   1:06.11   1:05.32

Fastest								Slowest

   b. 1:04   1:08.02   1:05.3   1:05.05   1:04.25   1:08   1:04.44   1:08.3   1:05

Fastest								Slowest

   c. 1:03.7   1:06.02   1:03.09   1:04.11   1:03   1:06.033   1:04.01   1:04.55   1:06.9

Fastest								Slowest

   d. From a, b, and c above, what are the three fastest times overall?

4. Write a set of five times (in order from fastest to slowest) that are all between 6:10 and 6:11. Do not include the given numbers in your set.

Name: ______________________________ Date: ______________

SKILL and PRACTICE 1.2

Reading Strategies (SQ3R)

READ

Commonly, we read a science textbook as if we were watching a movie—we just sit there and expect to take it all in. Actually, reading a science book is more like playing a video game. You have to interact with it! This skill sheet will teach you active strategies that will improve your reading and study skills. Remember—just like in video game playing—the more you practice these strategies, the more skilled you will become.

The **SQ3R** active reading method was developed in 1941 by Francis Robinson to help his students get the most out of their textbooks. Using the SQ3R method will help you interact with your text, so that you understand and remember what you read. "SQ3R" stands for:

- **Survey**
- **Question**
- **Read**
- **Recite**
- **Review**

Your student text has many features to help you organize your reading. These features are highlighted in Chapter 1: Science Is Everywhere. Open your text to Chapter 1 so that you can see the features for yourself.

Survey the chapter first.

- Skim the *introduction* on the first page of every chapter. Notice the *key questions*. The key questions are thought-provoking and will engage you in the chapter. See if you can answer these questions after you have read the entire chapter.
- You will find *vocabulary* words in the blue box with the definition on the right side of the page.Vocabulary words are scattered throughout the chapter. Write down any vocabulary words that are unfamiliar to you to help you recognize them later.
- Next, skim the chapter to get an overview. Notice the *section numbers and titles*. These divide the chapter into major topics. The *subheadings* in each section outline important points. Vocabulary words are highlighted in bold. Tables, charts, and figures summarize important information throughout each section.
- Read the *section review* questions at the end of each section. The questions help you identify what you are expected to know when you finish your reading. You will also find *Challenge* or *Solve It!* boxes with the section review. These boxes provide an interesting way to learn more about information in the section.
- At the end of each chapter you will find a reading called the *Chapter Connection* and the *Chapter Activity.* Connection readings are like magazine articles with interesting science facts. Chapter connection articles always end with a set of engaging questions for you to answer to test your reading comprehension. The chapter activity is a hands-on project that you can do in school or at home. The activity will help you learn more about the information in the chapter.
- Carefully read the *Chapter Assessment* at the end of the chapter to see what kinds of questions you will need to be able to answer. Notice that it is divided into four subtitles: Vocabulary, Concepts, Math and Writing Skills, and Chapter Project. These questions are listed by chapter section. The chapter project provides you with an additional way to practice new skills or learn information.

Question what you see. Turn headings into questions.

- Look at each of the section headings and subheadings, found at the top of pages in your text. Change each heading to a question by using words such as who, what, when, where, why, and how. For example, **Section 1.1: Learning about Science** could become *How do we learn about science?* The subheading **What is science?** would remain the same. The subheading **Fields of science** could become *What are some fields of science?* Write down each question and try to answer it. Doing this will help you pinpoint what you already know and what you need to learn as you read.

Read and look for answers to the questions you wrote.

- Pay special attention to the *sidenotes* in the left margin of each page. For example, under the subheading **What is science?** the sidenotes are **Observe, Ask a question,** and **Make a hypothesis.** These phrases and short sentences are designed to guide you to the main idea of each paragraph. Also note the sidebars and illustrations on the right side of the page with additional explanations and concepts. For example, **Figure 1.3** on page 6 of your text illustrates some important scientific fields.
- Slow your reading pace when you come to a difficult paragraph. Read difficult paragraphs out loud. Copy a confusing sentence onto paper. These methods force you to slow down and allow you time to think about what the author is saying.

Recite concepts out loud.

- This step may seem strange at first, because you are asked to talk to yourself! But studies show that saying concepts out loud can actually help you to record them in your long-term memory.
- At the end of each section, stop reading. Ask yourself each of the questions you wrote in step two on the previous page. Answer each question out loud, in your own words. Imagine that you are explaining the concept to someone who hasn't read the text.
- You may find it helpful to write down your answers. By using your senses of seeing, hearing, and touch (when you write) as you learn, you create more memory paths in your brain.

Review it all.

- Once you have finished the entire chapter, go back and answer all of the questions that you wrote for each section. If you can't remember the answer, go back and reread that portion of the text. Recite and write the answer again.
- Next, reread the key questions at the beginning of the chapter. Can you answers these?
- Complete the section reviews and different parts of the chapter assessment at the end of the chapter. Use the glossary and index at the back of the book to help you locate specific definitions.

PRACTICE

The SQ3R method may seem time-consuming, but it works! With practice, you will learn to recognize the important concepts quickly.

Active reading helps you learn and remember what you have read, so you have less to re-learn as you study for quizzes and tests.

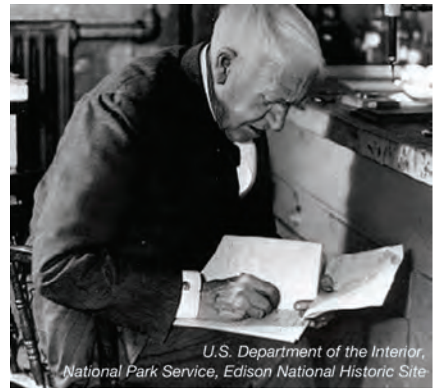
Name: ______________________ Date: ______________

SKILL and PRACTICE 1.2

Lab Notebooks

READ

A laboratory notebook is an important tool in science. The photograph at the right shows Thomas Edison writing in his notebook. He was a important inventor in the development of the modern light bulb.



U.S. Department of the Interior, National Park Service, Edison National Historic Site

What does a lab notebook look like?

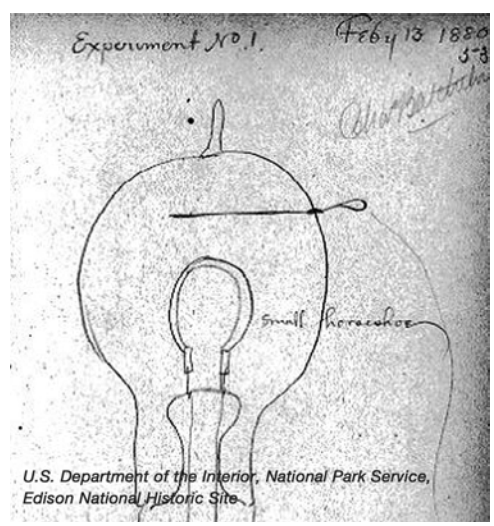
- Lab notebooks should be permanently bound.
- Each page should be numbered and dated.
- Write on pages in order. Make notes with page numbers if an entry has to continue on the following page or another page.
- Use ink when writing so that the information is not easily erased. Ball point pens or gel pens are good for resisting water spills.
- Write legibly in your notebook so that other people can read it.

PRACTICE

1. Why do you think it's important for the lab notebook to be permanently bound? In other words, why would you NOT want to use a loose-leaf or spiral-bound notebook?
2. Sylvia has just realized that she has discovered a new formula for toothpaste. She applies for a patent on her formula and learns that someone else has invented the same formula! She has kept her laboratory notebook up-to-date throughout her research. Could her notebook could help her prove that she discovered the formula first? If so, how?

What does a lab notebook contain?

A scientist's notebook contains observations and conclusions, experiments, drawings, and graphs. The image at the right is a page from the notebook of Thomas Edison. Study this image to answer the following questions.



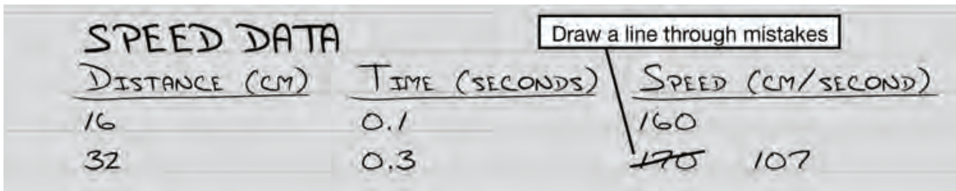
U.S. Department of the Interior, National Park Service, Edison National Historic Site

3. When was this page entered into Edison's notebook?
4. Why is it important to write the date on each page of your lab notebook?
5. To which number experiment is the drawing related?
6. Why might it be important to number your experiments in a scientific study?
7. What object does Thomas Edison's drawing represent?
8. Based on this lab notebook page, come up with a hypothesis about what Edison might have been working on or studying when he wrote this page.

Mistakes are okay in a lab notebook

Mistakes are common in a lab notebook. This is because lab notebooks are a record of a thought process. It is always important to write down ideas even if they are far-fetched. Of course, because a lab notebook is not a polished document, it is easy to make small written mistakes.

No matter what kind of mistake is made, you should never erase the mistake. This is because mistakes are an important record of the thought process and, importantly, mistakes can spark new ideas or discoveries. When a mistake is made, a line is drawn through it so that the word or number is still readable (see example below).



9. You write the following incorrect statement in your lab notebook: *The formula for speed of a car is time divided by distance.* Re-write this statement and draw a line through the incorrect part. Above the statement, write the correction.

10. State one reason why it is not a good idea to erase a mistake in a lab notebook.

Lab notebook format

Part of notebook	
Title page	Name, location, date (the first page).
Table of contents	Lists all contents of the notebook and is completed as the notebook pages are filled (two - three pages right after the title page).
What to write	The science process helps you know what to write. You should record your observations and book or Internet research that you do before, during, and after any experiment. Also, you should write your research question and your hypothesis. Write a short paragraph that justifies why you are making a particular hypothesis. Then record all the details of the experimental procedure (including a materials list), data, and calculations. Data can be descriptions or measurements. Tables and graphs of your data are very important. A conclusions paragraph summarizes your experiment and its results. In this paragraph, you state whether or not your hypothesis was correct and state any new hypotheses you have.

11. Why is it important to have a table of contents in your lab notebook?

12. You are about to begin an experiment to test which of two brands of sugarless gum keeps its flavor the longest. Make a sample lab notebook page for this experiment. Your materials include samples of two brands of sugarless gum and a stopwatch or watch with a second-hand. You will also need a group of people to test the gum. After you have made your sample page, compare it with others made by your classmates. Alternatively, your teacher might have a classroom discussion to talk about the important items to include on this sample page.

13. State two reasons why it is important to keep a detailed laboratory notebook of all your work in a lab.

Name: ____________________ Date: ____________________

Observations versus Opinions

READ

An observation is an accurate description of a thing or an event. An observation is a statement of fact. Here are some examples of facts based on evidence or observation:

- 2 + 2 = 4
- The Sun is the center of our solar system.
- My pizza has cheese and mushrooms on top of it.

These observations or facts can be proven to be true. On the other hand, an opinion about a subject is unique to the person that has that opinion. Opinions are based on one's experiences or beliefs. Here are some examples of opinions:

- Math is fun!
- In ten years, more people will be driving hybrid cars than will be driving gasoline-only powered cars.
- I don't like mushrooms on my pizza.

Now, practice identifying and interpreting observations and opinions.

PRACTICE

1. The mathematical statement, 2 + 2 = 4, is a fact. Imagine you have a bunch of apples. How could you use the apples to prove this statement is a fact?
2. The mathematical statement, 10 ÷ 2 = 5, is a fact. Imagine you have a 10 oranges. How could you use the oranges to prove this statement is a fact?
3. The statement, Earth rotates one time each day (24 hours), is a fact. List some pieces of evidence that support this fact.
4. The statement, "Math is fun!" is an opinion. How can you prove that this statement is an opinion? Write a short paragraph to answer this question.
5. Your teacher has ordered three pizzas for your class. One is a cheese pizza, one is a cheese and mushroom pizza, and one is a cheese and pepperoni pizza. After lunch, you notice that the cheese pizza is all gone. You also notice that half of the pepperoni pizza is left over and half of the cheese and mushroom pizza is left over. Make a statement of fact about this situation based on this pizza data.
6. Your school wants to pick new school colors. You would like the colors to be green and yellow. A survey of all the students reveals that 60% of the students prefer blue and yellow, 15% prefer green and yellow, and 25% prefer red and yellow. From this scenario, state one opinion and one observation.
7. Next year, you will be one year older and in the next grade. State one opinion about next year. Now, state one fact about next year that you know to be true.

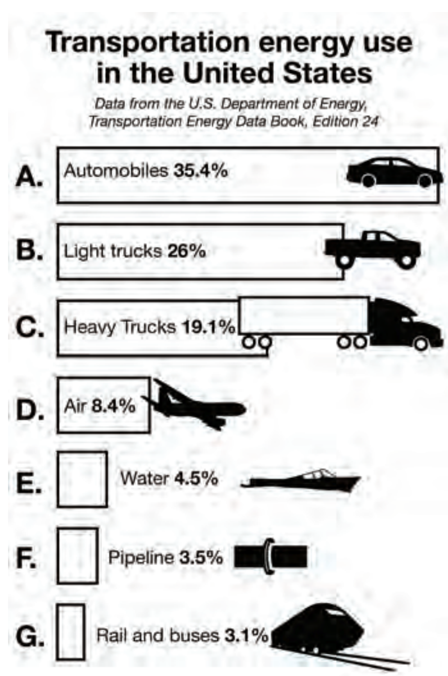
8. A hypothesis is a type of opinion based on observations and evidence. If a hypothesis is proven by one experiment, it may be true. However, in science, many experiments need to occur to fully test a hypothesis. From the following data collected by growing four plants grown under different colors of light, state a hypothesis.

Color of light	White light	Blue light	Green light	Red light
Plant number and height	#1, 10 cm	#2, 8 cm	#3, 5 cm	#4, 7 cm

9. The five senses are seeing, hearing, touching, tasting, and smelling. Each of these senses can be valuable in making observations.
Imagine that you are at a baseball game. What kinds of things would you see, hear, touch, taste, and smell at a baseball game? In the table below list possible observations for each sense. In the next column, list an opinion related to each sense.

Sense	Observation	Opinion
Seeing		
Hearing		
Touching		
Tasting		
Smelling		

10. Here is a bar graph of transportation energy use in the United States. List five observations about this bar graph. Then, list two opinions that you can form from studying this graph.



Name:____________________________ Date: ________________

Geerat (Gary) Vermeij

Gary Vermeij probably knows more about molluscs—a group of animals including snails and shellfish—than anyone else alive today. He studies both mollusc fossils and living molluscs from around the world.

Early years in Holland

Gary Vermeij (Ver-MAY) was born in Holland in 1947. There, his parents learned that extra fluid inside Gary's eyes was damaging his vision. Gary remembers seeing colors, but shapes were never very sharp. Doctors tried to fix the problem. But when Gary was three, he became completely blind.

Gary's parents loved the outdoors. They took him on walks where he picked up shells, pine cones, and little creatures that lived in the grass. He wanted to know the names of each one.

Gary went to a boarding school for blind students. He hated being away from home. When he was nine, his family moved from Holland to New Jersey. There, he could live at home and go to the local school.

Fourth grade discoveries

When Gary was in fourth grade, his teacher went to Florida. She brought back a bunch of shells and set them on a windowsill to decorate the classroom.

The shells amazed Gary. The shapes were so fancy. These shells were smoother and felt more polished than shells he had collected in Holland and New Jersey.

Gary says the first scientific question he asked himself was, "Why are these Florida shells so much prettier than the shells from Holland? Why don't they have the same chalky texture?"

A growing interest

Gary's interest in shells grew. His family made trips to the shore, where he added to his collection. His parents and brother read aloud every book they could find on seashore animals and plants.

Gary worked hard in school. He had Braille textbooks and used a typewriter for his homework. He finished high school with the highest grades in his class!

More questions

In college, Gary studied biology and geology. Then he went to Yale University. There, he had to write a long paper that answered a scientific question.

Can you guess what he chose to write about? Gary's paper explained some reasons why snails from warm oceans are different from cool ocean ones.

Gary discovered that a cool-water snail has to use a lot more energy to build a shell than a warm-water snail does, so its home is usually simpler.

Warm-water snails, Gary found, also have stronger, fiercer predators. They need stronger shells in order to survive.

A scientist's life

Gary's days are busy. He teaches classes in biology, ecology, and geology at the University of California-Davis.

He also does a lot of field work—which means getting into the water to observe molluscs where they live. He says, "I have been stung by rays and bitten by crabs, and I have slipped on rocks and suffered from stomach cramps. There isn't a field scientist who hasn't had things like these happen. Life without risk is life without challenge. You can't hope to understand nature without experiencing it firsthand."

Gary writes books and articles in science journals to share what he learns. He writes about predator-prey relationships, why some molluscs have become extinct, and what happens when an animal invades a new area.

If you want to be a scientist…

Gary has some advice for students who want to be scientists. He says you need to be curious, hard working, and willing to risk being wrong sometimes.

Reading reflection

1. What did Gary like to do as a little boy in Holland?
2. How did Gary first become interested in shells?
3. How did his family help him learn about shells?
4. Gary said, “I have been stung by rays and bitten by crabs, and I have slipped on rocks and suffered from stomach cramps. There isn’t a field scientist who hasn’t had things like these happen. Life without risk is life without challenge.”

   Think about the statement, “Life without risk is life without challenge.”
   There are two kinds of risks: foolish risks, like riding in a car without buckling your seat belt, and healthy risks, like trying out for the soccer team even though you might not make it.
   List three healthy risks you have taken in your life. Write a paragraph to explain what you learned from each one.
5. Gary says to be a scientist you have to be willing to risk being wrong sometimes. Why do you think this is important?

Extension:

6. Think about a time when you were curious about something in nature. What scientific question did you ask?
7. Name three ways you could get more information to answer your scientific question. (Example: E-mail a university professor.)
8. **Research:** Choose one way to get information to answer your question. Write a paragraph to read out loud so you can share your answer with your classmates.

Name: ______________________ Date: ______________

Types of Graphs

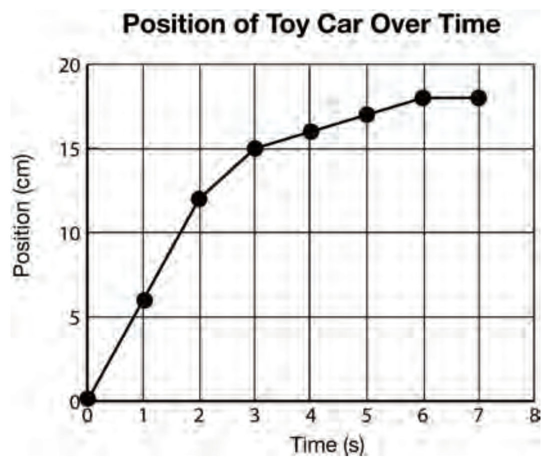
READ

A graph is a picture that helps you understand data. Graphs are easier to read than tables of numbers, so they are often used to display data collected during an experiment. The three main types of graphs you will use are line graphs, bar graphs, and pie graphs. With a little practice, you will be able to identify these types of graphs and recognize which type of data best fits which type of graph.

EXAMPLES

Line Graph

A line graph shows how the *independent variable* causes the *dependent variable* to change in value. The data graphed at right shows how far a toy car traveled down a ramp over a period of time. For this data set, the independent variable is the time traveled. The dependent variable is the position of the car. The two variables are related. The position of the car **depends** on how long it has been traveling.



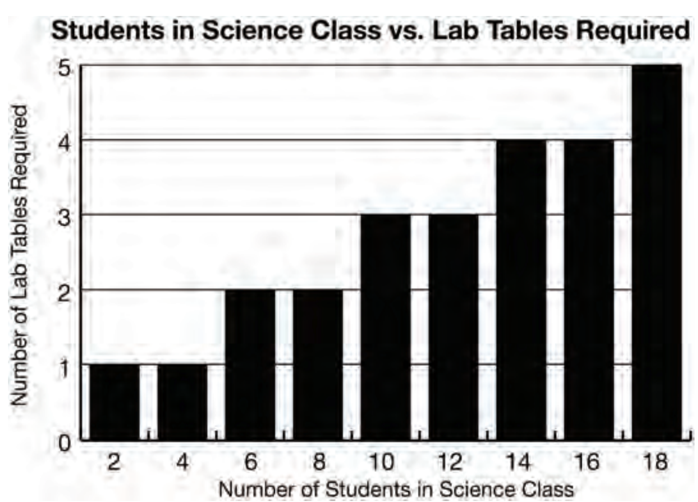
Line graphs are the best type of graph to use when your independent variable is *continuous*, meaning that the data continues uninterrupted between each of the points in your data set.

Time is a continuous independent variable because you can divide it into smaller and smaller pieces, like half a second or a tenth of a second, or even smaller. The data could have been collected at any of these points.

If your data is continuous and one of your variables causes the other to change in value, use a line graph.

Bar Graph

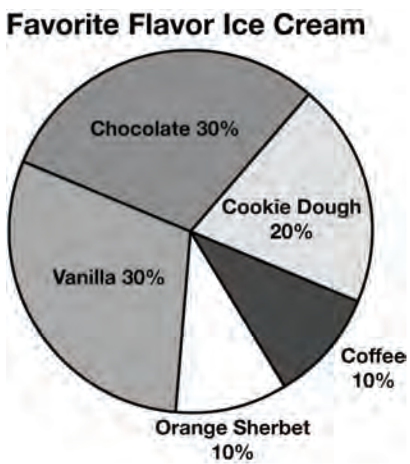
A bar graph is best for comparing separate categories of information. The graph is made of a series of "bars" of different values drawn along an axis. The data shown in this bar graph relates the number of students in a science classroom to how many lab tables are needed.



Like line graphs, bar graphs have an independent and a dependent variable. For this data set, the independent variable is the number of students and the dependent variable is the number of lab tables needed. The number of lab tables **depends** on the number of students.

Use a bar graph when your variables compare categories of information, or when your data is *not continuous*. This means that your data consists of exact values—like a certain number of students. You can have an exact number of students, like four or six or ten, but you cannot have a continuous number, like 4.5 students. If your data is something that was counted rather than measured, it is probably *not continuous*.

Pie Graphs



A pie graph is a circular graph that compares the parts of something to the whole. The data is usually written in percentages or fractions of the whole. Each part is drawn as a "slice" of the pie, so you can compare the different sizes of the "slices" to each other **and** to the whole pie. Surveys usually give data sets that work well in pie graphs.

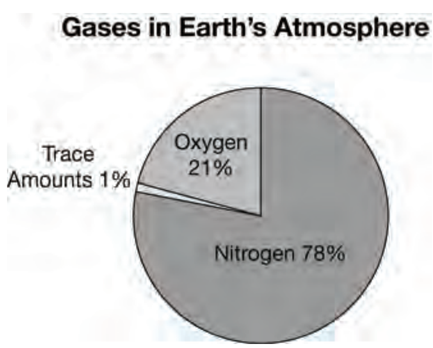
For this graph, a class of sixth grade students was given a survey asking them to identify their favorite flavor of ice cream.

PRACTICE 1

Name the type of graph shown in the following four examples

.

Graph #1:

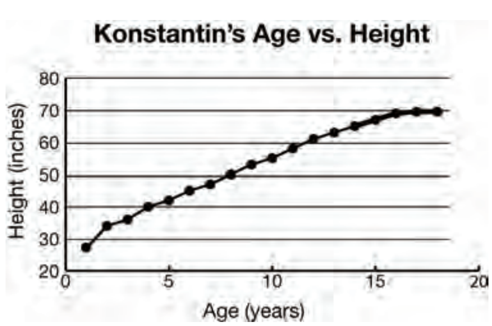


Type of graph _______________________

Graph #2:

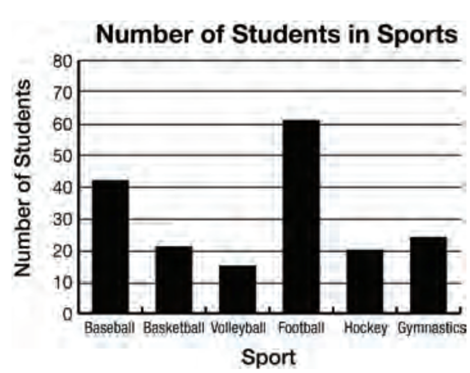
Type of graph _______________________

Graph #3:



Type of graph _______________________

Graph #4:



Type of graph _______________________

SKILL and PRACTICE 1.3

PRACTICE 2

Describe which type of graph—line graph, bar graph, or pie graph—would be most appropriate for the following data sets. Explain your reason.

Data Set #1: Most Popular Dog Breeds in Middleton

Dog Breed	Percent of Middleton dog owners who own this breed of dog	Type of graph you would use:
Golden Retriever	30%	Reason:
German Shepherd	20%	
Beagle	20%	
Poodle	20%	
Rottweiler	10%	

Data Set #2: Length of Students' First Names

First Name	Number of letters	Type of graph you would use:
Jasmine	7	Reason
Alejandra	9	
Kenji	5	
Lola	4	
Jordan	6	

Data Set #3: Air Temperature

Time	Air Temperature (°F)	Type of graph you would use:
3 pm	86	Reason
4 pm	88	
5 pm	84	
6 pm	80	
7 pm	79	

Data Set #4: How Students Get to School

Method	Number of students who get to school with this method	Type of graph you would use:
Bus	16	Reason
Walk	10	
Car	8	
Taxi	1	
Bicycle	3	

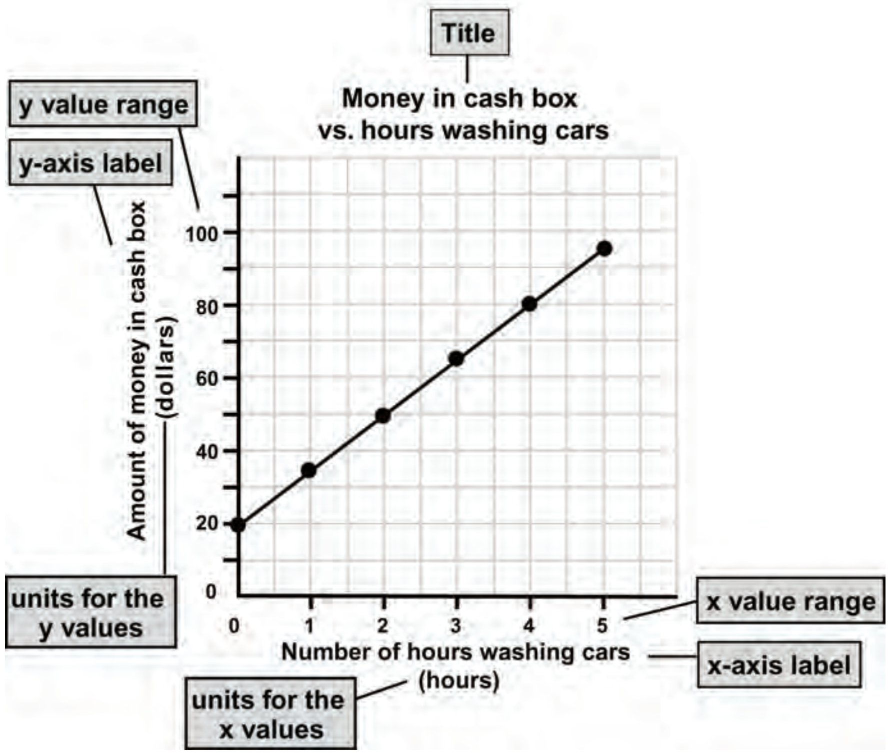
Name: ______________________________ Date: ______________

SKILL and PRACTICE 1.3

Reading Graphs

READ

- The three main kinds of graphs are line graphs, bar graphs, and pie graphs.
- To learn how to interpret graphs, we will start with an example of a line graph. The data presented on the graph below is the money earned during a car wash that lasted for five hours. Use this graph to follow the steps and answer the questions below.



PRACTICE

Step 1: Read the labels on the graph.

1. What is the title of the graph?
2. Read the labels for the *x*-axis and the y-axis. What two variables are represented on the graph?

Step 2: Read the units used for the variable on the *x*-axis and the variable on the *y*-axis.

3. What unit is used for the variable on the *x*-axis?
4. What unit is used for the variable on the *y*-axis?

Step 3: Look at the range of values on the *x*- and *y*-axes. Do the range of values make sense? What would the data look like if the range of values on the axes was spread out more or less?

5. What is the range of values for the x-axis?

6. The range of values for the *y*-axis is 0 to $120. What would the graph look like if the range of values was 0 to $500? Where would the data appear on the graph if this were the case?

Step 4: After looking at the parts of the graph, pay attention to the data that is plotted. Is there a relationship between the two variables?

7. Is there a relationship between the variables that are represented on the graph?

Step 5: Write a sentence that describes the information presented on the graph. For example, you may say, "As the values for the variable on the *x*-axis increase, the values for the variable on the *y*-axis decrease."

8. Write your own description of the graph on page one.

9. The theater club at your school needs to raise $1000 for a trip that they want to take. They will be taking the trip next fall. It is now April. Based on the graph, would you recommend that the group wash cars to raise money? Write out a detailed response to this question. Be sure to provide evidence to support your reasons for your recommendation.

PRACTICE

Now apply what you know about interpreting graphs to a bar graph. Use the steps from part one to help you answer the questions.

1. What is the title of this graph?

2. What variables are represented on the graph? (Hint: there are three variables.) Describe each variable in terms of the categories or the range of values used.

3. Write a sentence that describes how the percentage of teenagers employed compares from city to city. Do not state any conclusions about the data in your sentence.

4. Write a sentence that describes how the percentage of boys employed compares to the percentage of girls employed. Do not state any conclusions about the data in your sentence.

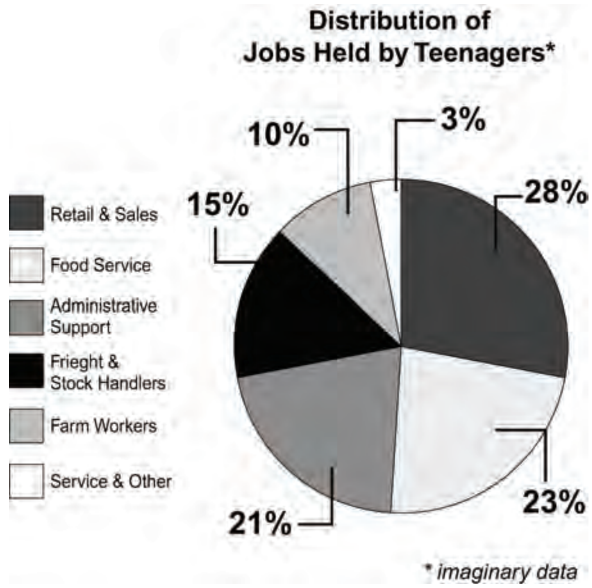
5. Based on the data represented in the graph, come up with a hypothesis for why the percentage of teenagers employed differs from city to city.

SKILL and PRACTICE 1.3

6. Based on the data represented in the graph, come up with a hypothesis to explain the employment differences between boys and girls in these cities.

PRACTICE

Now apply what you know about interpreting graphs to a pie graph. Use the steps from part one to help you answer the questions.



1. What is the title of this graph?
2. What variables are represented on the graph? (Hint: there are two variables.)
3. Are any units used in this graph? Explain your answer.
4. If you were going to report on this data, what would you say? Write two to three sentences that describe this graph. Do not state any conclusions about the data in your sentence.
5. Come up with a hypothesis based on the data in this graph. Briefly describe how you would test your hypothesis.
6. Do you have a job? If so, in which category does your job fit? Do you think this pie graph accurately represents the working teenager population in your area? Explain your response.

Name: ______________________________ Date: ______________

SKILL and PRACTICE 1.3

Study Notes

READ

This skill sheet will help you take notes while you read. Each paragraph in the text has a sidenote. Fill in the table as you read each section of your textbook. Use the information to study for tests!

- First, write in the number of the section that you are reading. For example, the first section of the text is 1.1. This is the first section in chapter 1 of the text.
- For each paragraph that you read, write the sidenote. Then, write a question based on this sidenote. As you read the paragraph, answer your own question.
- When you study, fold this paper so that the answers are hidden. Use separate paper to write answers to each of your questions. Then unfold this paper and check your work.

EXAMPLE

An example of how to fill in the table:

Page number	Sidenote text	Question based on sidenote	Answer to question
4	Make a hypothesis	How do I make a hypothesis?	First I make observations that lead to a scientific question. A hypothesis is a possible answer to the question based on my observations.

PRACTICE

Section number: __________

Page number	Sidenote text	Question based on sidenote	Answer to question

Section number: _________

Page number	Sidenote text	Question based on sidenote	Answer to question

Name: ______________________________ Date: ______________

SKILL and PRACTICE 1.3

Scientific Method

READ

The scientific method helps you find answers to your questions about the world. It starts with a question and a possible answer to the question based on your observations. This “answer” is called your hypothesis. The next step is to test your hypothesis by creating experiments that can be repeated by other people in other places. If your experiment is repeated many times with the same results and conclusions, this information becomes part of the scientific knowledge we have about the world.

Steps to the Scientific Method
1. Make observations.
2. Ask a question.
3. State a hypothesis.
4. Collect data.
5. Draw conclusions.

- Read the following story. You will use this story to practice using the scientific method.

  Anna and her father are going away for a week to visit relatives. The relatives live ten hours away by car. It is warm outside when they leave for the trip, so her father closes the windows and turns on the air conditioning. Anna has been learning about energy conservation in science class and wonders if the air conditioning makes the car use a lot more gas. The car is driving on the freeway, and there is not a lot of traffic. Opening the windows would keep the car cool enough. She asks her father if he thinks it would be better to open the windows to save on fuel. Her father believes that opening the windows would be worse because it makes the car less aerodynamic. Anna thinks he is wrong. They decide to do an experiment to find out whether it is better to use the air conditioner or open the windows.
- Now, answer the following questions about the process they used to reach their conclusion.

PRACTICE

Make observations

1. What are the observations that Anna has made?

Ask a question

2. What question do Anna and her father want to answer during the experiment?

State a hypothesis

3. What is Anna’s father’s hypothesis for the experiment?

4. What is Anna’s hypothesis for the experiment?

Collect data

5. What data will Anna and her father have to collect during the experiment?

   They get off the freeway at the next exit and fill the gas tank.They decide to drive for the next three hours with the air conditioning on and the windows closed.

6. What piece of data should they record before they start driving?

   Three hours later, they stop for lunch and fill up the gas tank.

7. What two pieces of data should they record while they are at the gas station?

   When they get back on the freeway, they turn off the air conditioning and drive with the windows down. They stop again for gas in three hours.

8. What information should they record?

Draw conclusions

When the air conditioning was on, they drove 187 miles and used 5.5 gallons of gas. With the windows open, they drove 160 miles and used 5 gallons of gas.

9. If you look at the data (without doing calculations), can you tell which way of driving was more efficient?

10. The car's fuel efficiency can be evaluated by calculating the number of miles traveled per gallon of gasoline used. Divide the miles traveled by the gallons of gas used to calculate the mpg for each way of driving.

11. What should Anna and her father conclude about this experiment?

12. Were the conditions of the two parts of the experiment identical? Explain.

13. How do you think Anna and her father could get more accurate results?

Name: ______________________ Date: ______________

SKILL and PRACTICE 2.1

Dimensional Analysis

READ

Dimensional analysis is a way to tell what the correct label (also called units or dimensions) for the solution to a problem should be. In dimensional analysis, we treat the units the same way that we treat the numbers. For example, this problem shows how you can "cancel" the sixes and then perform the multiplication:

$$\frac{5}{\cancel{6}} \bullet \frac{\cancel{6}}{7} = \frac{5}{7}$$

In some problems, there are no numerical cancellations to make, but pay close attention to the units (or dimensions):

$$\frac{9 \text{ weeks}}{1} \bullet \frac{7 \text{ days}}{1 \text{ week}} = \frac{9 \bullet 7 \bullet \text{weeks} \bullet \text{days}}{1 \text{ week}} = \frac{63 \cancel{\text{weeks}} \text{ days}}{\cancel{1 \text{ week}}} = 63 \text{ days}$$

The "weeks" may be cancelled either before or after the multiplication.

The goal of dimensional analysis is to simplify a problem by focusing on the units of measurement (dimensions).

Dimensional analysis is very useful when converting between units (like converting inches to yards, or converting between the metric and English systems of measurement.

EXAMPLE

- How many minutes are there in one day?

Solution:

a. Determine what it is that we want to find out: $\frac{\text{minutes}}{\text{day}}$.

It's important to remember that if the solution is to have the label $\frac{\text{minutes}}{\text{day}}$:

Minutes should be kept in the numerator (or top part of the fraction).
Day(s) should be kept in the denominator (or bottom part of the fraction).

b. Determine what we know. We know that there are **60** minutes in an hour and **24** hours in a day.

c. Write what you know mathematically (fractions). Here, we have: $\frac{60 \text{ min}}{1 \text{ hr}} \bullet \frac{24 \text{ hr}}{1 \text{ day}}$

d. Set up the problem by focusing on the units (dimensions).

Just writing the information from #3 as a multiplication problem, we have: $\frac{60 \text{ min}}{1 \text{ hr}} \bullet \frac{24 \text{ hr}}{1 \text{ day}}$

Looking *only* at the units, hr(s) cancel, leaving just: $\frac{\text{min}}{\cancel{\text{hr}}} \bullet \frac{\cancel{\text{hr}}}{\text{day}} = \frac{\text{min}}{\text{day}}$

e. Calculate:

$$\frac{60 \text{ min}}{1 \text{ hr}} \bullet \frac{24 \text{ hr}}{1 \text{ day}} = \frac{60 \bullet 24 \text{ min} \bullet \cancel{\text{hr}}}{1 \cancel{\text{hr}} \bullet \text{day}} = \frac{1{,}440 \text{ min}}{\text{day}}$$

Notice that canceling the units can be done either before or after the multiplication.

f. Check your solution for reasonableness: Since there are 60 minutes in just one hour, it is expected that there would be many minutes in an entire day. It does seem reasonable that there are 1,440 minutes in a day.

PRACTICE

1. Multiply. Be sure to label your answers.

   a. $\frac{30 \text{ mi}}{1 \text{ gallon}} \bullet \frac{12 \text{ gallons}}{1 \text{ tank}}$

   b. $\frac{70 \text{ feet}}{\text{second}} \bullet 60 \text{ seconds}$

   c. $\frac{15 \text{ mi}}{\text{hr}} \bullet \frac{1 \text{ hr}}{60 \text{ min}} \bullet 30 \text{ min}$

2. Use dimensional analysis to convert each. You may need to use a reference to find some conversion factors. Show all of your work.

   a. 15 pints to some number of quarts

   b. 30,000 feet to some number of miles

   c. 28,800 seconds to some number of hours

3. Use dimensional analysis to find each solution. You may need to use a reference to find some conversion factors. Show all of your work.

   a. On Saturday, Sammie ran a 5k road race. How far is this in miles?

   b. DeAndre earns $6.25 per hour. He works 6 hours each day, five days each week. What are his weekly earnings?

   c. Using the information from “b”: If DeAndre has two weeks of unpaid vacation this year, how much does he earn for the year?

   d. Simon fills his gas tank. Gas costs $3.39 per gallon. His tank will hold 12 gallons of gas. How much does it cost Simon to fill his tank?

   e. A wide receiver for a professional football team has a 40-inch vertical jump. How much is this in centimeters?

   f. Lorraine has set a goal of collecting at least 100 pieces of candy during trick-or-treating this Halloween. From past years, she thinks she will average 2 pieces of candy from each home she visits. Her brother expects to do the same. Lorraine can also count on collecting half of her little brother's candy. If she goes with her brother, how many houses must Lorraine visit in order to accomplish her goal?

   g. Greg can type 33 words in 1 minute. How many words does he average per second?

Name: ______________________ Date: ______________

SI System

READ

Scientists do experiments to test their ideas. They share their results in science magazines and journals. Other scientists repeat the experiments to see if they get the same results. When results are confirmed, we learn more about how the world works.

If you want other people to be able to repeat your work, you need to make careful measurements. Scientists use SI units because they are easy to convert from one measurement to another. In the English system, there are 12 inches in a foot, 3 feet in a yard, and 5,280 feet in a mile. SI units are in multiples of 10. There are 10 millimeters in a centimeter, 100 centimeters in a meter, and 1,000 meters in a kilometer.

In this skill sheet, you will learn how easy it is to convert one SI unit to another.

Basic units

The table below shows some basic units you will use for measuring things in your science classes:

When you are measuring:	Use this basic unit:	Symbol of unit:
Mass 	gram	g
Length 	meter	m
Volume 	liter	l

Prefixes

When measuring things that are much larger or much smaller than the basic unit, you'll use a prefix along with the basic unit. The following prefixes tell you to multiply the basic unit by a certain amount. For example, the prefix kilo- means "multiplied by 1,000." A kilometer is equal to 1,000 meters, and a kilogram is equal to 1,000 grams.

Prefix:	kilo-	hecto-	deka-	Basic unit (no prefix)	deci-	centi-	milli-
Symbol:	k	h	da	m, l, g	d	c	m
Multiply the basic unit by:	1,000	100	10	1	0.1	0.01	0.001

SI Unit Conversions

Converting between SI units becomes easy with a little practice. Below you'll find a method that uses a place value chart to help you keep track of where to move the decimal point.

EXAMPLES ▶

- **How many centimeters are in 50 meters?**

  (1) Restate the question: 50 meters = __________ centimeters

  (2) Use the place value chart below to figure out what to multiply 50 meters by:

prefix	kilo-	hecto-	deka-	meter, liter or gram	deci-	centi-	milli-
place value	thousands	hundreds	tens	ones	tenths	hundredths	thousandths

  Since we want to convert meters (ones place) to centimeters (hundredths place), count the number of places on the chart it takes to move from the ones place to the hundredths place.

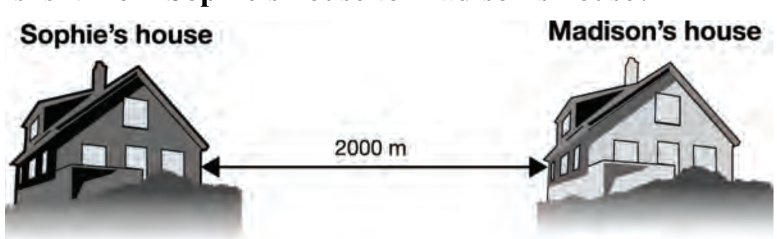
  Since it takes 2 moves to the right, you multiply by 100.

$$1.00 = 100.$$

  Solution: multiply 50 × 100 = 5,000. **Answer:** There are 5,000 centimeters in 50 meters.

  Did you notice that multiplying by 100 is the same as moving the decimal two places to the right? The chart tells you where to move the decimal place, so that you don't even need to do the multiplication!

- **How many kilometers is it from Sophie's house to Madison's house?**



  (1) Restate the question: 2,000 meters = __________ kilometers

  (2) Use the place value chart to figure out what to multiply 2,000 meters by.

prefix	kilo-	hecto-	deka-	meter, liter or gram	deci-	centi-	milli-
place value	thousands	hundreds	tens	ones	tenths	hundredths	thousandths

  Since we want to convert meters (ones place) to kilometers (thousands place), count the number of places on the chart it takes to move from the ones place to the thousands place.

  Since it takes 3 moves to the left, multiply by 0.001.

$$0001. = 0.001$$

  Solution: multiply 2,000 × 0.001 = 2. **Answer:** The distance is 2 kilometers.

  In the second example problem, did you notice that multiplying by 0.001 is the same as moving the decimal three places to the left? Use this shortcut to solve the problems on the following pages.

PRACTICE

1. How many grams are in 1 kilogram?

   a. Restate the question: 1 kg = __________ g

   b. Use the place value chart to figure out where to move the decimal point:

prefix	kilo-	hecto-	deka-	meter, liter or gram	deci-	centi-	milli-
place value	thousands	hundreds	tens	ones	tenths	hundredths	thousandths

   I will move the decimal __3__ places to the __right__.

   c. 1 kg = _____ g

2. How many centimeters are there in one millimeter?

   a. Restate the question: 1 mm = __________ cm

   b. Use the place value chart to figure out where to move the decimal point:

prefix	kilo-	hecto-	deka-	meter, liter or gram	deci-	centi-	milli-
place value	thousands	hundreds	tens	ones	tenths	hundredths	thousandths

   I will move the decimal __1__ place to the __left__.

   c. 1 mm = _____ cm

3. Convert 420 centimeters to meters.

   a. Restate the question: 420 cm = __________

   b. Use the place value chart to figure out where to move the decimal point:

prefix	kilo-	hecto-	deka-	meter, liter or gram	deci-	centi-	milli-
place value	thousands	hundreds	tens	ones	tenths	hundredths	thousandths

   I will move the decimal __________ places to the __________.

   c. 420 cm = __________

4. How many milliliters are in 5 liters?

   a. Restate the question: __________ = __________

   b. Use the place value chart to figure out where to move the decimal point:

   I will move the decimal __________ places to the __________.

   c. __________ = __________

Challenge!

Use the place value chart to answer the following questions:

prefix	kilo-	hecto-	deka-	meter, liter or gram	deci-	centi-	milli-
place value	thousands	hundreds	tens	ones	tenths	hundredths	thousandths

5. How many centimeters are in 6 kilometers?
6. A car has a mass of 1,200 kilograms. How many grams is this?
7. Convert 50 dekameters to decimeters.
8. How many hectoliters are equal to 150 deciliters?
9. Seven hundred sixty two centiliters is equal to how many liters?
10. Sixteen milliseconds is equal to how many seconds?
11. How many milliseconds are in 60 seconds?
12. How many times smaller than a meter is a centimeter?
13. How many times larger than a gram is a kilogram?
14. Name the volume that is 100 times larger than a liter.

Name: ______________________________ Date: ________________

SI-English Unit Conversions

How many inches are there in a foot? How many quarts in a gallon? How many ounces in a pound? The answers to these questions (12, 4, and 16) may be quite simple for you. Most people who have grown up in the United States can answer these questions because the English system of measurement is used in their daily lives.

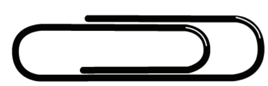
You may also have learned that it's quite easy to convert between SI units (like meters to centimeters) by knowing the SI prefix place-values, and how to move the decimal point. If you have lived in another country, you are probably very familiar with SI units. Occasionally (especially in science), it is necessary to convert SI units to English (like kilometers to miles), and English units to SI units (like ounces to grams). It may be helpful to be familiar with some common examples of how SI units compare with English measurements:

One kilometer (1 km) is about two and a half times around a standard running track.

One centimeter (1 cm) is about the width of your little finger.

One kilogram (1 kg) is about the mass of a full one-liter bottle of drinking water.

One gram (1 g) is about the mass of a paper clip.



One liter (1 l) is a common size of a small bottle of drinking water.

One milliliter (1 mL) is about one droplet of liquid.

When precise conversions between the two systems are needed, use these conversion factors:

English - metric measurement equivalents

Measurement	Equivalents
Length	1 inch = 2.54 centimeters 1 kilometer ≈ 0.62 mi
Volume	1 liter ≈ 1.06 quart
Mass	1 ounce ≈ 28 grams 1 kilogram ≈ 2.2 pounds

EXAMPLES

How many inches are equivalent to 10 centimeters?

1. Restate the question, starting with what is known: 10 centimeters = _____ inches.
2. Find the conversion factor from the table: 1 in = 2.54 cm.
3. Write the information from steps 1 and 2 as ratios: $\frac{10 \text{ cm}}{1}$, and $\frac{1 \text{ in}}{2.54 \text{ cm}}$
4. Multiply the ratios. Make sure the units cancel correctly to produce the desired type of unit in the answer. In this case, centimeters cancel, leaving inches, which is what we are supposed to be finding.

$$\frac{10 \cancel{\text{ cm}}}{1} \times \frac{1 \text{ in}}{2.54 \cancel{\text{ cm}}} = \frac{10 \text{ in}}{2.54 \text{ cm}} \approx 3.9 \text{ cm}$$

What is the mass of a 5 pound bag of flour in kilograms?

1. Restate the question: 5 lbs ≈ ____ kg.
2. Find the conversion factor from the table: 1 kg ≈ 2.2 lb (The abbreviation for *pound* is *lb*.)
3. Write the information from steps 1 and 2 as ratios: $\frac{5 \text{ lb.}}{1}$, and $\frac{1 \text{ kg}}{2.2 \text{ lb}}$
4. Multiply the ratios making sure that the unwanted units cancel, leaving kilograms in the numerator:

$$\frac{5 \cancel{\text{ lb.}}}{1} \times \frac{1 \text{ kg}}{2.2 \cancel{\text{ lb.}}} \approx 2.3 \text{ kg}$$

How many quarts are equivalent to 3 liters?

1. Restate the question: 3 liters ≈ ______quarts.
2. Find the conversion factor from the table: 1 × L ≈ 1.06 qt.
3. Write the information from steps 1 and 2 as ratios: $\frac{3 \text{ L}}{1}$, and $\frac{1 \text{ L}}{1.06 \text{ qt}}$
4. Multiply the ratios making sure that the unwanted units cancel, leaving only the desired units (quarts) in the answer: Notice that in this case, the units do not cancel the way they should. To correct this, just rewrite the

ratios so that they do cancel the way they need to (here liters should cancel, leaving “quarts” in the numerator):

$$\frac{3\,\not{L}}{1} \times \frac{1.06\text{ qt}}{1\,\not{L}} \approx 3.18\text{ qt}$$

PRACTICE

1. 250 g ≈ ____ oz
2. 8 L ≈ ____ qt
3. 100 kg ≈ ____ lbs
4. How many inches are equivalent to 15 centimeters?
5. How many liters are equivalent to 1.8 quarts?
6. Josh ran an 8K (8 kilometer) road race last Saturday. How many miles did he run?
7. The letter that Mrs. Gibson needs to mail today weighs 2.4 ounces. How many grams does the letter weigh?
8. Jordan's house is two and one half miles away from the park. How far is this in kilometers?
9. A sign for a kiddie ride at a carnival says you must be under 42 inches tall to ride. How tall is this in centimeters?
10. Challenge: The basketball hoop in Marvin's driveway is 9 ½ feet tall. How tall is this in centimeters?

Name: ______________________________ Date: ______________

SKILL and PRACTICE 2.2

Temperature Scales

READ

The Fahrenheit and Celsius temperature scales are commonly used for reporting temperature values. Scientists use the Celsius scale almost exclusively, as do many countries of the world. The United States relies on the Fahrenheit scale for reporting temperature information. You can convert information reported in degrees Celsius to degrees Fahrenheit or vice versa using conversion formulas.

Fahrenheit (°F) to Celsius (°C) conversion formula: $°C = \frac{5}{9}(°F - 32)$

Celsius (°C) to Fahrenheit (°F) conversion formula: $°F = \left(\frac{9}{5} \times °C\right) + 32$

EXAMPLES

- What is the Celsius value for 65° Fahrenheit?

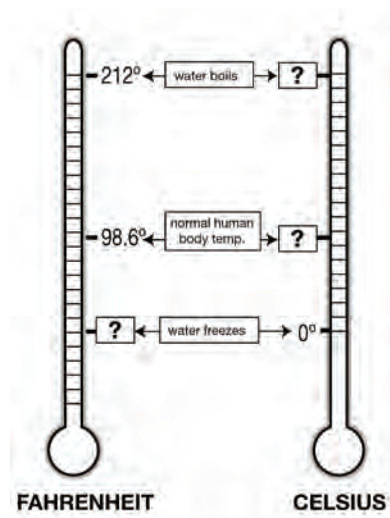
Step 1: Subtract	$°C = \left(\frac{5}{9}\right)(65°F - 32)$
Step 2: Multiply	$°C = \left(\frac{5}{9}\right)(33) = (5 \times 33) \div 9$
Step 3: Divide	$°C = (165) \div 9$
	$°C = 18.3$

- 200°C is the same temperature as what value on the Fahrenheit scale?

	$°F = \left(\frac{9}{5}\right)(200°C) + 32$
Step 1: Multiply	$°F = [(9 \times 200°C) \div 5] + 32$
Step 2: Divide	$°F = [1800 \div 5] + 32$
Step 3: Add	$°F = 360 + 32$
	$°F = 392$

PRACTICE

1. For each of the problems below, show your calculations. Follow the steps from the examples above.
   a. What is the Celsius value for 212°F?
   b. What is the Celsius value for 98.6°F?
   c. What is the Celsius value for 40°F?
   d. What is the Celsius value for 10°F?
   e. What is the Fahrenheit value for 0°C?
   f. What is the Fahrenheit value for 25°C?
   g. What is the Fahrenheit value for 75°C?



2. The weatherman reports that today will reach a high of 45°F. Your friend from Sweden asks what the temperature will be in degrees Celsius. What value would you report to your friend?

3. Your parents order an oven from England. The temperature control on the new oven is calibrated in degrees Celsius. If you need to bake a cake at 350°F in the new oven, at what temperature should you set the dial?

4. A German automobile's engine temperature gauge reads in Celsius, not Fahrenheit. The engine temperature should not rise above about 225°F. What is the corresponding Celsius temperature on this car's gauge?

5. Your grandmother in Ireland sends you her favorite cookie recipe. Her instructions say to bake the cookies at 190.5°C. To what Fahrenheit temperature would you set the oven to bake the cookies?

6. A scientist wishes to generate a chemical reaction in his laboratory. The temperature values in his laboratory manual are given in degrees Celsius. However, his lab thermometers are calibrated in degrees Fahrenheit. If he needs to heat his reactants to 232°C, what temperature will he need to monitor on his lab thermometers?

7. You call a friend in Denmark during the winter holidays and say that the temperature in Boston is 15 degrees. He replies that you must enjoy the warm weather. Explain his comment using your knowledge of the Fahrenheit and Celsius scales. To help you get started, fill in this table. What is 15°F on the Celsius scale? What is 15°C on the Fahrenheit scale?

°F		°C
15°F	=	
	=	15°C

8. Challenge questions:

   a. A gas has a boiling point of -175°C. At what Fahrenheit temperature would this gas boil?

   b. A chemist notices some silvery liquid on the floor in her lab. She wonders if someone accidentally broke a mercury thermometer, but did not thoroughly clean up the mess. She decides to find out if the silver stuff is really mercury. From her tests with the substance, she finds out that the melting point for the liquid is 35°F. A reference book says that the melting point for mercury is -38.87°C. Is this substance mercury? Show your work and explain your answer.

   c. It is August 1 and you are at a Science Camp in Florida. During an outdoor science quiz, you are asked to identify the temperature scale for a thermometer that reports the current temperature as 90. Is this thermometer calibrated for the Fahrenheit or the Celsius temperature scale? Fill in the table below to answer this question.

°F		°C
90°F	=	
	=	90°C

Name: ______________________ Date: ______________

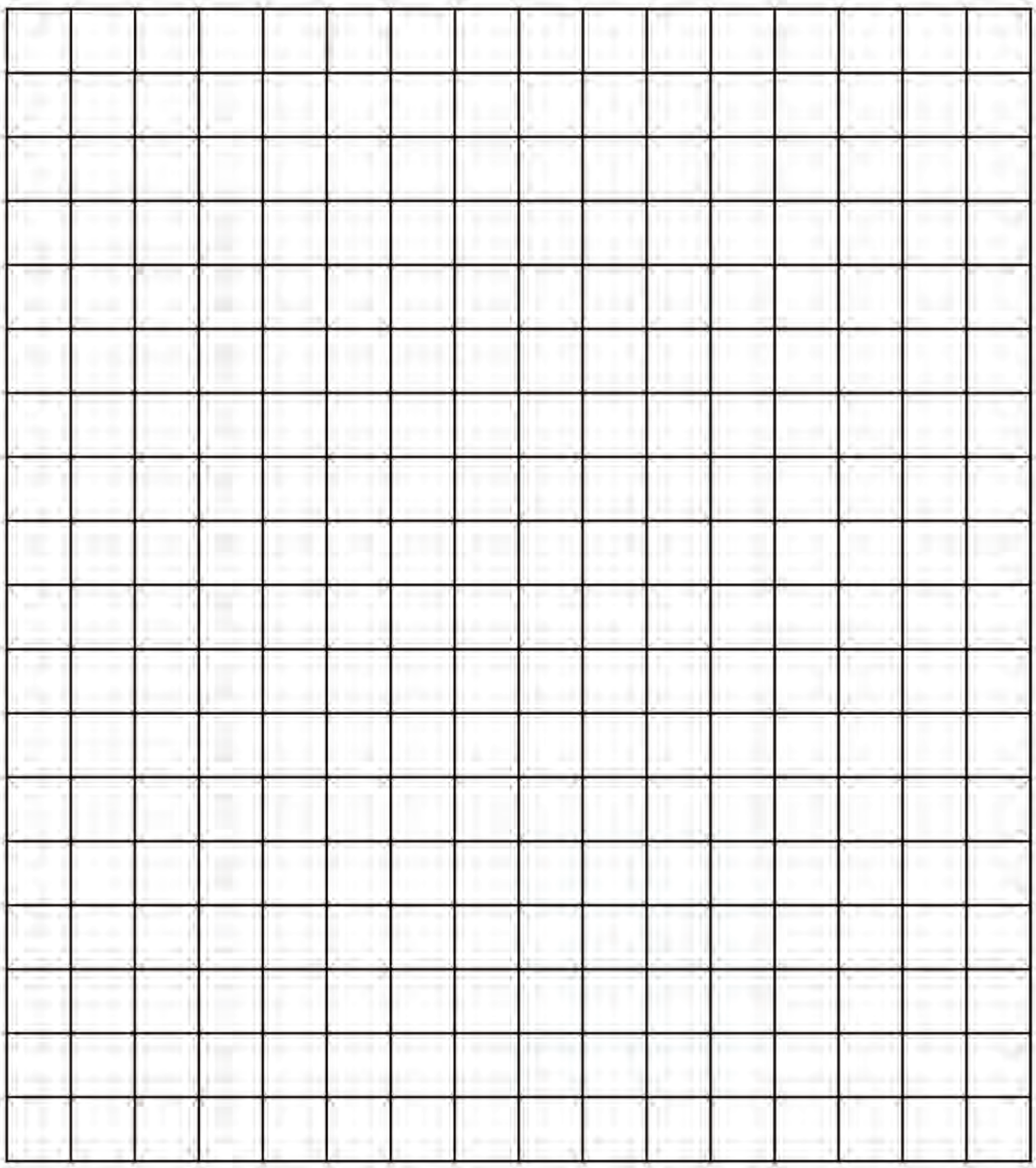
SKILL and PRACTICE 2.3

Calculating Area

READ

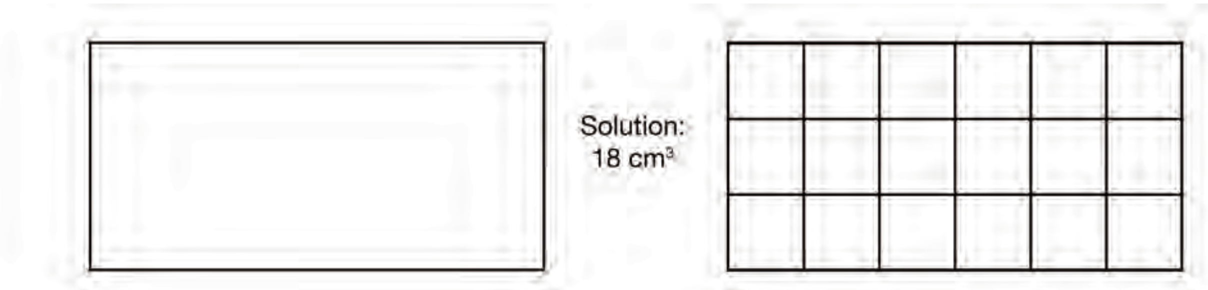
Suppose you want to buy a new carpet for your room. How do you figure out what size to get? You need to know how much floor space needs to be covered. Areas like floor space are measured in square units. Below you can see a grid measured off in square centimeters. In Earth Science class, you'll also become familiar with square meters and square kilometers.

Cut out the grid below. You'll use it as a measuring tool to answer the problems on the next page.



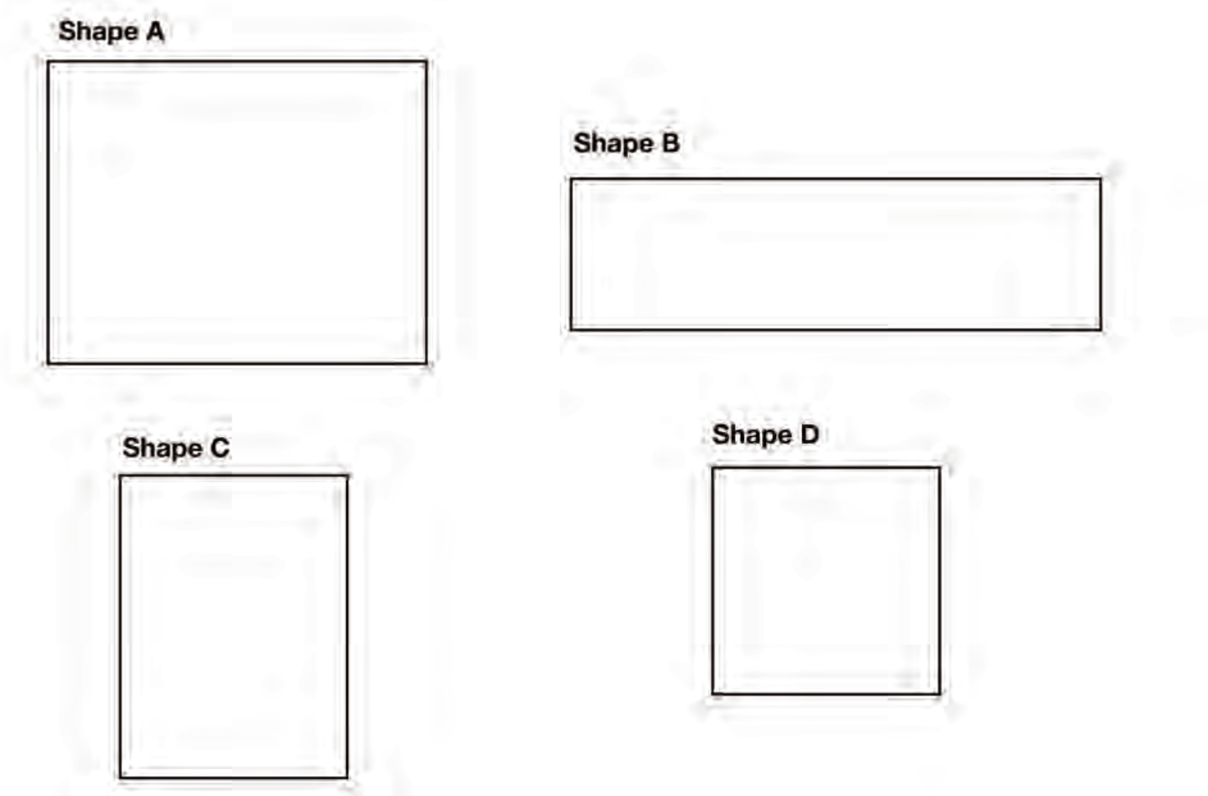
EXAMPLE

- Measure the space below using your grid as a guide. Give your answer in square centimeters.



PRACTICE

1. Measure the spaces below using your grid as a guide. Give your answer in square centimeters.



2. How many squares wide is each shape above? How many squares long?

Shape A: __________ wide __________ long
Shape B: __________ wide __________ long
Shape C: __________ wide __________ long
Shape D: __________ wide __________ long

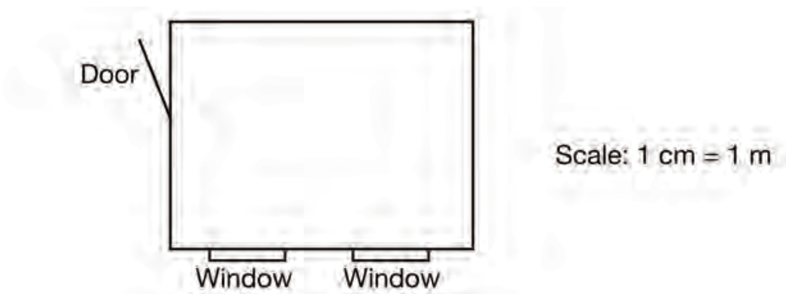
3. What is the relationship between length, width, and area for a rectangle?

Area and mapping

Maps are an important tool for Earth science. On maps, one small unit (like a square centimeter) is used to represent a larger unit (like a square meter or a square kilometer). When reading a map, you will measure area using the small unit, and then convert your measurement to the larger unit.

EXAMPLE

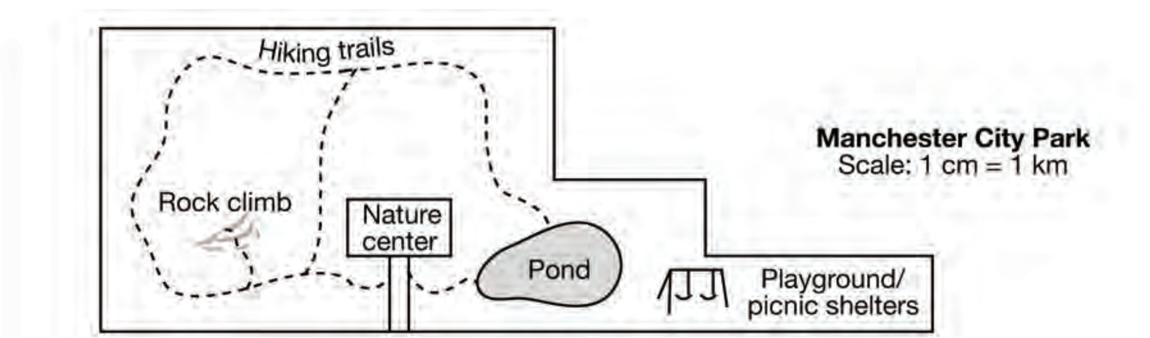
How much carpet does Talia need to buy to cover the floor in her room?



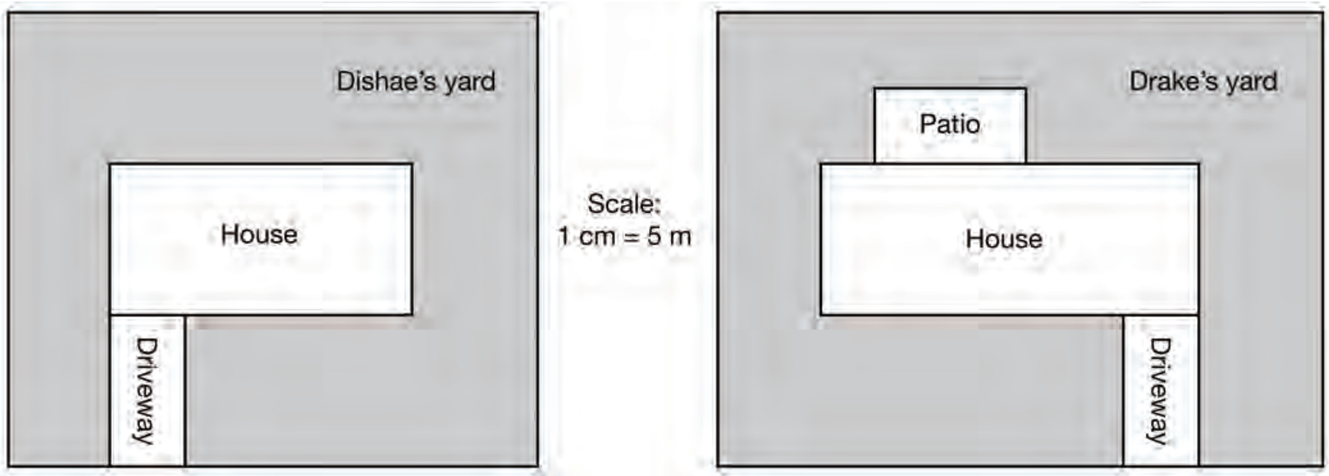
On the map, Talia's room measures 3 cm by 4 cm. One square centimeter on the map is equal to one square meter in Talia's room. Talia needs to buy 12 square meters of carpet.

PRACTICE

1. How many square kilometers will the city of Manchester's new park occupy?



2. Dishae and Drake have each been asked to mow the lawn. How many square meters of yard does each student have to mow? Hint: 1 cm^2 on the map = 25 m^2 to mow!



3. **Challenge!** Use your grid sheet and the back of this paper to make up your own area problem.

Name: ______________________ Date: ______________

Science Vocabulary

SKILL and PRACTICE 2.3

READ

When you study science, you may see words that are new to you. Many words in the English language can be broken down into roots, prefixes, and suffixes to understand their meaning. These word parts often come from Latin or Greek words. In this exercise, you will become familiar with how to break a word into its parts and discover the meaning of a variety of scientific words.

Building blocks of language

Roots, prefixes, and suffixes are the building blocks of language.

- A *root* is a word base—the part that gives the word its core meaning. A root can appear at the beginning, middle, or end of a word.
- A *prefix* is a word part added to the beginning of a word or root.
- A *suffix* is a word part added to the end of a word or root.

EXAMPLES

Using prefixes, roots, and suffixes

Below is a list of words you may encounter studying earth science. Look for prefixes, suffixes, and roots. Separate the word into it parts using the columns next to the word. All words should have a root word. Hint: all three columns will not be used in every case.

Do some of the word parts look familiar already? You will get a chance to review their meanings in the next section.

Word	Prefix	Root	Suffix
geology		*geo-*	*-logy*
lithosphere			
paleontology			
astronomy			
seismogram			

Building science vocabulary

Now that you know how to break a word into its parts, you are ready to learn the meaning of some common word parts in science. Some of these words come from early Greek and Latin and were borrowed by English, French, Spanish, and Italian languages. If you speak one of these languages, the word parts and meanings may be familiar to you.

Prefixes		Roots		Suffixes	
alt-	high	*aqua-*	water	*-al*	of, relating to
circum-	around	*astro-*	star	*-ate*	to act on or change
equ-	equal	*cycl-*	circle	*-gram*	a written record
hemi-	half	*form-*	to shape	*-graph*	something written or drawn
litho-	rock	*geo-*	earth, land	*-ic*	related to
paleo-	ancient	*onto-*	to break	*-ism*	the act, state, or theory of
pre-	before	*photo-*	light	*-ist*	person who is or does
semi-	half	*scope-*	to see	*-ity, -ty*	degree of
strat-	to spread	*seismo-*	shake, earthquake	*-logy*	study of
sub-	under	*sphere-*	ball, globe	*-meter*	to measure
tele-	distant	*terra-*	earth, land	*-nomy*	to name, to manage

PRACTICE

Learning new words

Using the table above, write in the meanings of the word parts below. Then give your best definition of the word. There is room for you to make up two words of your own from the word parts listed above.

Word	Prefix	Root	Suffix	Definition
geology				
lithosphere				
paleontology				
astronomy				
seismogram				

SKILL and PRACTICE 2.3

Check the meaning

Now, using a dictionary, look up the words from the table. Write the formal definitions in the spaces below. Try looking up your words, too! Were you close to the correct meaning?

1. geology:

   ____

2. lithosphere:

   ____

3. paleontology:

   ____

4. astronomy:

   ____

5. seismogram:

   ____

6. ______________________:

   ____

7. ______________________:

   ____

Name: ______________________________ Date: ______________

SKILL and PRACTICE 2.3

Variables

READ

Science experiments are designed with an experimental variable and control variables. An experimental variable is the variable in the experiment that is changed on purpose. In order to study the effect of the experimental variable, everything else in the experiment must remain the same. A variable that is kept the same in an experiment is called a control variable.

EXAMPLE

John has observed different air temperatures above different surfaces on Earth. He asked, "What types of surfaces are identified with warmer temperatures in the air?" John hypothesized that the air temperature above dark soil would be warmer than the air temperature above a body of water. In order to test his hypothesis, John followed the following procedure.

a. Obtain two identical glass containers with glass lids.

b. Put 5 centimeters of room temperature water in one container and 5 centimeters of room temperature soil in the other container. Put a thermometer (same brand and model) in each container.

c. Place the lid on both containers.

d. Set each container 30 centimeters away from an incandescent light. Make sure each container is exactly the same distance from the light. Also, be sure that the lights are identical and that the bulbs have the same wattage.

e. Record the temperature of each container.

f. Turn the lights on.

g. Record the temperature of each container every minute for 15 minutes.

The experimental variable in this experiment is the material at the surface of Earth. There are several control variables. They include the size, shape, and material of the containers, the depth of the surface, the light source, the distance from the light source, the time exposed to light.

PRACTICE

1. You observe that dew forms very often on summer mornings. You ask, "What temperature would our classroom have to be in order for dew to form on the various surfaces in the room?" You and your classmates hypothesize that dew will form at 5°C. In order to test your hypothesis, you and your classmates complete the following experiment.

    a. All students complete the experiment at the same time.

    b. Obtain a metal can from your teacher.

    c. Record the air temperature in the room in degrees Celsius.

    d. Fill the metal can ½ full with room-temperature water.

    e. Put a thermometer in the water and allow it to sit for 1 minute.

    f. At this point, slowly begin adding ice chips. Continually stir the water in the can with the thermometer.

g. When you see condensation or dew on the outside of the can, record the temperature. (This is the dew point of the room.)

h. Repeat the experiment three times with the same materials. Find the average starting air temperature and the dew point temperature for all four trials.

Identify the experimental variable and three control variables in the experiment.

2. You have learned the following in science class. When water turns from a liquid to gas below the boiling temperature, the process is called evaporation. You have observed that water evaporates at different speeds in different conditions. You ask, "What causes the rate of evaporation of water to increase?" You hypothesize that when water is heated, the rate of evaporation will increase. In order to test your hypothesis, you and your classmates complete the following experiment.

   a. Obtain two 50-mL glass beakers.

   b. Fill each beaker with 50 mL of water at 25°C. Put a thermometer in each of the filled beakers.

   c. Place one beaker on the counter in the classroom.

   d. Place another beaker under an incandescent lamp. Be sure the light does not shine on the other beaker. Turn on the light.

   e. Record the water level of each beaker and the temperature of each beaker every hour for 10 hours.

   Identify the experimental variable and three control variables in the experiment.

3. Throughout your life you have seen many streams. You have noticed that different streams flow at various speeds. You ask, "What factors cause streams to flow at a faster rate?" You hypothesize that streams that have a steep slope will flow faster than streams that have a gentle slope. In order to test your hypothesis you perform the following experiment.

   a. Obtain one stream table.

   b. Place one end of the stream table 5 cm above the lab bench. Place the other end of the stream on the lab bench.

   c. Put a bucket at the end of the stream table where it is resting on the lab bench.

   d. Pour 500 mL of water from high end of the stream so that it flows toward the bucket.

   e. Record how long it takes for all of the water to empty into the bucket.

   f. Now prop the end of the stream table that was 5 cm above the lab bench to 10 cm above the lab bench.

   g. Repeat steps d and e.

   h. Now prop the end of the stream table that was 10 cm above the lab bench to 15 cm above the lab bench.

   i. Repeat steps d and e.

   j. Finally, prop the end of the stream table that was 15 cm above the lab bench to 20 cm above the lab bench.

   k. Repeat steps d and e.

   Identify the experimental variable in the experiment and two control variables in the experiment.

Name: ______________________________ Date: ____________________

SKILL and PRACTICE 2.4

Types of Graphs

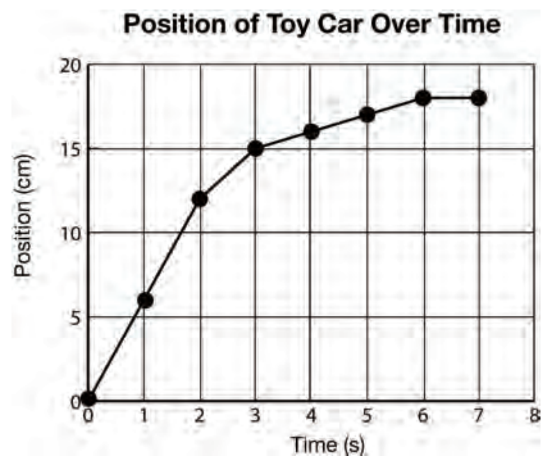
READ

A graph is a picture that helps you understand data. Graphs are easier to read than tables of numbers, so they are often used to display data collected during an experiment. The three main types of graphs you will use are line graphs, bar graphs, and pie graphs. With a little practice, you will be able to identify these types of graphs and recognize which type of data best fits which type of graph.

EXAMPLES

Line Graph

A line graph shows how the *independent variable* causes the *dependent variable* to change in value. The data graphed at right shows how far a toy car traveled down a ramp over a period of time. For this data set, the independent variable is the time traveled. The dependent variable is the position of the car. The two variables are related. The position of the car **depends** on how long it has been traveling.



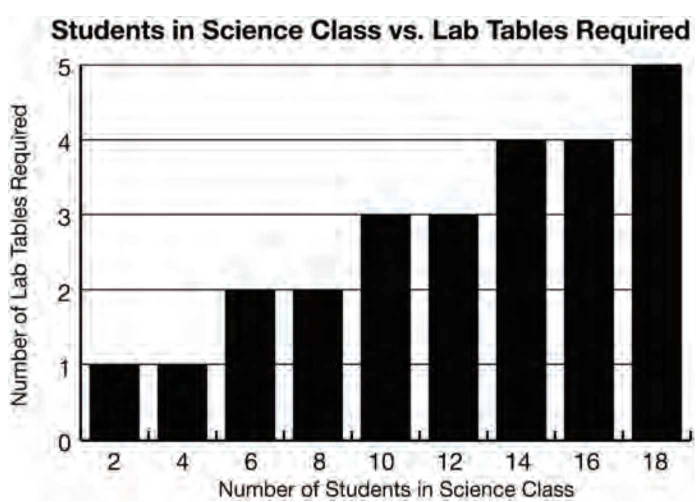
Line graphs are the best type of graph to use when your independent variable is *continuous*, meaning that the data continues uninterrupted between each of the points in your data set.

Time is a continuous independent variable because you can divide it into smaller and smaller pieces, like half a second or a tenth of a second, or even smaller. The data could have been collected at any of these points.

If your data is continuous and one of your variables causes the other to change in value, use a line graph.

Bar Graph

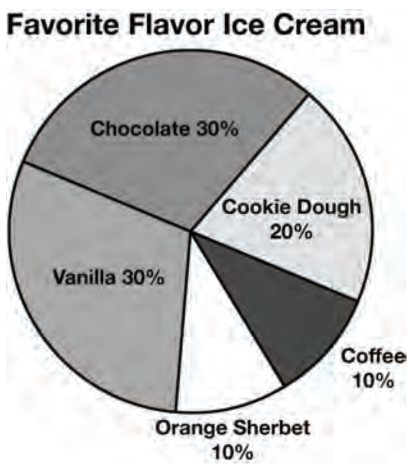
A bar graph is best for comparing separate categories of information. The graph is made of a series of "bars" of different values drawn along an axis. The data shown in this bar graph relates the number of students in a science classroom to how many lab tables are needed.



Like line graphs, bar graphs have an independent and a dependent variable. For this data set, the independent variable is the number of students and the dependent variable is the number of lab tables needed. The number of lab tables **depends** on the number of students.

Use a bar graph when your variables compare categories of information, or when your data is *not continuous*. This means that your data consists of exact values—like a certain number of students. You can have an exact number of students, like four or six or ten, but you cannot have a continuous number, like 4.5 students. If your data is something that was counted rather than measured, it is probably *not continuous*.

Pie Graphs



A pie graph is a circular graph that compares the parts of something to the whole. The data is usually written in percentages or fractions of the whole. Each part is drawn as a "slice" of the pie, so you can compare the different sizes of the "slices" to each other **and** to the whole pie. Surveys usually give data sets that work well in pie graphs.

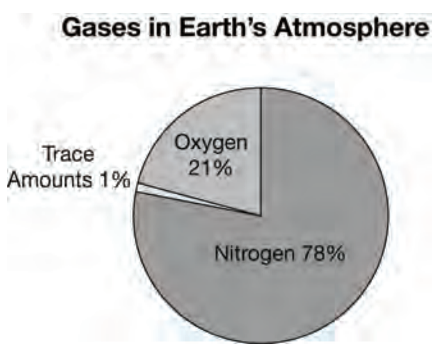
For this graph, a class of sixth grade students was given a survey asking them to identify their favorite flavor of ice cream.

PRACTICE 1

Name the type of graph shown in the following four examples

.

Graph #1:

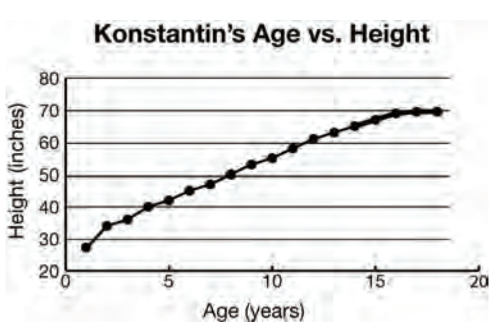


Type of graph _______________________

Graph #2:

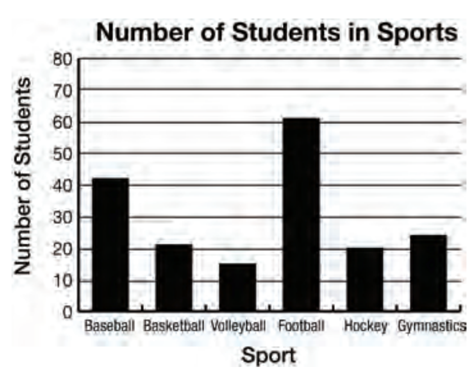
Type of graph _______________________

Graph #3:



Type of graph _______________________

Graph #4:



Type of graph _______________________

PRACTICE 2

Describe which type of graph—line graph, bar graph, or pie graph—would be most appropriate for the following data sets. Explain your reason.

Data Set #1: Most Popular Dog Breeds in Middleton

Dog Breed	Percent of Middleton dog owners who own this breed of dog	Type of graph you would use:
Golden Retriever	30%	Reason:
German Shepherd	20%	
Beagle	20%	
Poodle	20%	
Rottweiler	10%	

Data Set #2: Length of Students' First Names

First Name	Number of letters	Type of graph you would use:
Jasmine	7	Reason
Alejandra	9	
Kenji	5	
Lola	4	
Jordan	6	

Data Set #3: Air Temperature

Time	Air Temperature (°F)	Type of graph you would use:
3 pm	86	Reason
4 pm	88	
5 pm	84	
6 pm	80	
7 pm	79	

Data Set #4: How Students Get to School

Method	Number of students who get to school with this method	Type of graph you would use:
Bus	16	Reason
Walk	10	
Car	8	
Taxi	1	
Bicycle	3	

Name: ______________________ Date: ______________

PRACTICE 2.4

Drawing Line Graphs

READ

Graphs allow you to present data in a form that is easy to understand. Line graphs include these important parts:

1. **Data pairs:** Graphs are made using pairs of numbers. Each pair of numbers represents one data point on a graph. The first number in the pair represents the independent variable and is plotted on the *x*-axis. The second number represents the dependent variable and is plotted on the *y*-axis.
2. **Axis labels:** The label on the *x*-axis is the name of the independent variable. The label on the *y*-axis is the name of the dependent variable. Be sure to write the units of each variable in parentheses after its label.
3. **Scale:** The scale is the quantity represented per line on the graph. The scale of the graph depends on the number of lines available on your graph paper and the range of the data. Divide the range by the number of lines. To make the calculated scale easy-to-use, round the value to a whole number.
4. **Title:** The format for the title of a graph is: “Dependent variable name versus independent variable name.”

PRACTICE

1. For each data pair in the table, identify the independent and dependent variable. Then, rewrite the data pair according to the headings in the next two columns of the table The first two data pairs are done for you.

	Data pair (not necessarily in order)		Independent (*x*-axis)	Dependent (*y*-axis)
1	Temperature	Hours of heating	Hours of heating	Temperature
2	Stopping distance	Speed of a car	Speed of a car	Stopping distance
3	Number of people in a family	Cost per week for groceries		
4	Stream flow rate	Amount of rainfall		
5	Tree age	Average tree height		
6	Test score	Number of hours studying for a test		
7	Population of a city	Number of schools needed		

2. Using the variable range and number of lines, calculate the scale for an axis. The first two are done for you.

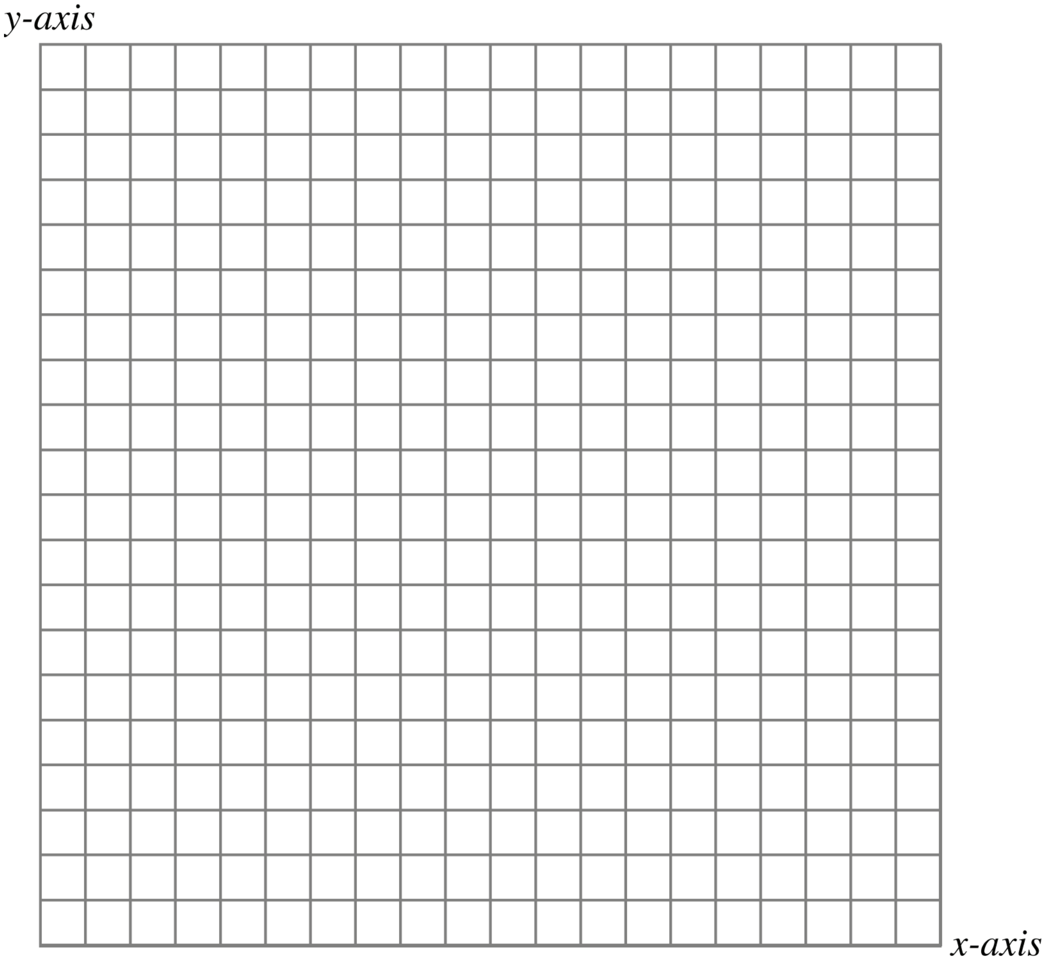
Variable range	Number of lines	Range ÷ Number of lines	Calculated scale	Adjusted scale
13	24	13 ÷ 24 =	0.54	1
83	43	83 ÷ 43 =	1.93	2
31	35			
100	33			
300	20			
900	15			

3. Here is a data set for you to plot as a graph. Follow these steps to make the graph.
   a. Place this data set in the table below. Each data point is given in the format of (*x*, *y*). The *x*- values represent time in minutes. The *y*-values represent distance in kilometers.
   (0, 5.0), (10, 9.5), (20, 14.0), (30, 18.5), (40, 23.0), (50, 27.5), (60, 32.0).

Independent variable (*x*-axis)	Dependent variable (*y*-axis)

   b. What is the range for the independent variable?
   c. What is the range for the dependent variable?
   d. Make your graph using the blank graph below. Each axis has twenty lines (boxes). Use this information to determine the adjusted scale for the *x*-axis and the *y*-axis.
   e. Label your graph. Add a label for the *x*-axis, *y*-axis, and provide a title.
   f. Draw a smooth line through the data points.

g. Question: What is position value after 45 minutes? Use your graph to answer this question.



Name: ______________________ Date: ______________

What's the Scale?

READ

Graphs allow you to present data in a form that is easy to understand. With a graph, you can see whether your data shows a pattern and you can picture the relationship between your variables.

The **scale** on a graph is the quantity represented per line on the graph. Your graph's scales will depend on the data you are plotting. Each of your graph's axes has its own separate scale. You need to be consistent with your scales. If one line on a graph represents 1 cm on the *x*-axis, then it has to stay that way for the entire *x*-axis.

When figuring out the scale for your graph, you first need to know the **range**. When you want your axis to start at zero, your range is equal to your highest data value. Once you have the range, you can calculate the scale. Count the number of lines you have available on your graph paper. Now, divide the range by the number of lines. This number is your scale. Then you adjust your scale by rounding up to a whole number.

EXAMPLE

Calculate the scales for the data set listed in the table below. Your graph paper is 20 boxes by 20 boxes.

Time (hours)	Amount of rainfall (mL)
5	5
10	11
15	21
20	28
25	37
30	59

Identify the variables.

1. Which is the independent variable? Time is your independent variable; it goes on the *x*-axis.
   Which is the dependent variable? Amount of rainfall is your dependent variable; it goes on the *y*-axis.

Find the ranges.

2. What is the range of data for the x-axis? 30 hours
   What is the range of data for the y-axis? 59 mL

Calculate the scales

3. What is the scale for your *x*-axis? 30 hrs divided by 20 boxes = 1.5 hrs/box rounded up to 2 hrs/box
   Each line on the graph is equal to 2 hours
   The *x*-axis will start at zero and go up to 40 hours, with each line counting as 2 hours.

   What is the scale for your *y*-axis? 59 mL divided by 20 boxes = 2.95 mL/box rounded up to 3 mL/box
   Each line on the graph is equal to 3 mL
   The *y*-axis will start at zero and go up to 60 mL, with each line counting as 3 mL.

PRACTICE

1. Given the variable range and the number of lines, calculate the scale for an axis. Often the calculated scale is not an easy-to-use value. To make the calculated scale easy-to-use, round the value and write this number in the column with the heading "Adjusted scale." The first two are done for you.

Range from 0	Number of Lines	Range ÷ Number of Lines	Calculated scale	Adjusted scale (whole number)
14	10	14 ÷ 10 =	1.4	2
8	5	8 ÷ 5 =	1.6	2
1000	20	1000 ÷ 20 =		
547	15	547 ÷ 15 =		
99	30	99 ÷ 30 =		
35	12	35 ÷ 12 =		

2. Calculate the range and the scale for the *x*-axis starting at zero, given the following data pairs and a 30 box by 30 box piece of graph paper. Each data point is given in the format of (*x*, *y*): (1, 27), (30, 32), (20, 19), (6, 80), (15, 21).

3. Calculate the range and the scale for the *y*-axis starting at zero, given the following data pairs and a 10 box by 10 box piece of graph paper. Each data point is given in the format of (*x*, *y*): (1, 5), (2, 10), (3, 15), (4, 20), (5, 25).

4. Calculate the scale for both the *x*-axis and the *y*-axis of a graph using the data set in the table below. Your graph paper is 20 boxes by 20 boxes. Start both the *x*- and *y*-axis at zero.
   a. Which is the independent variable? Which is the dependent variable?
   b. What is the range of data for the *x*-axis? What is the range of data for the *y*-axis?
   c. What is the scale for your *x*-axis? What is the scale for your *y*-axis?

Day	Average Daily Temperature (°F)
1	67
3	68
5	73
7	66
9	70
11	64

Name: ______________________________ Date: ______________

SKILL and PRACTICE 3.1

Internet Research Skills

READ

The Internet is a valuable tool for finding answers to your questions about the world. A search engine is like an on-line index to information on the World Wide Web. There are many different search engines from which to choose. Search engines differ in how often they are updated, how many documents they contain in their index, and how they search for information. Your teacher may suggest several search engines for you to try.

EXAMPLE

Search engines ask you to type a word or phrase into a box known as a *field*. Knowing how search engines work can help you pinpoint the information you need. However, if your phrase is too vague, you may end up with a lot of unhelpful information.

How could you find out who was the first woman to participate in a space shuttle flight?

First, put **key phrases** in quotation marks. You want to know about the "first woman" on a "space shuttle." Quotation marks tell the engine to search for those words together.

Second, if you only want websites that contain both phrases, **use a + sign** between them. Typing **"first woman" + "space shuttle"** into a search engine will limit your search to websites that contain both phrases.

If you want to broaden your search, use the word **or** between two terms. For example, if you type **"first female" or "first woman" + "space shuttle"** the search engine will list any website that contains either of the first two phrases, as long as it also contains the phrase "space shuttle."

You can narrow a search by using the word **not.** For example, if you wanted to know about marine mammals other than whales, you could type **"marine mammals" not "whales"** into the field. Please note that some search engines use the minus sign (-) rather than the word **not**.

PRACTICE 1

1. If you wanted to find out about science museums in your state that are not in your own city or town, what would you type into the search engine?
2. If you wanted to find out which dog breeds are not expensive, what would you type into the search engine?
3. How could you research alternatives to producing electricity through the combustion of coal or natural gas?

READ

The quality of information found on the Internet varies widely. This section will give you some things to think about as you decide which sources to use in your research.

1. **Authority:** How well does the author know the subject matter? If you search for "Newton's laws" on the Internet, you may find a science report written by a fifth grade student, and a study guide written by a college professor. Which website is the most authoritative source?
   Museums, national libraries, government sites, and major, well-known "encyclopedia sources" are good places to look for authoritative information.

2. **Bias:** Think about the author's purpose. Is it to inform, or to persuade? Is it to get you to buy something? Comparing several authoritative sources will help you get a more complete understanding of your subject.

3. **Target audience:** For whom was this website written? Avoid using sites designed for students well below your grade level. You need to have an understanding of your subject matter at or above your own grade level. Even authoritative sites for younger students (children's encyclopedias, for example) may leave out details and simplify concepts in ways that would leave gaps in your understanding of your subject.

4. **Is the site up-to-date, clear, and easy to use?** Try to find out when the website was created, and when it was last updated. If the site contains links to other sites, but those links don't work, you may have found a site that is infrequently or no longer maintained. It may not contain the most current information about your subject. Is the site cluttered with distracting advertisements? You may wish to look elsewhere for the information you need.

PRACTICE 2

1. What is your favorite sport or activity? Search for information about this sport or activity. List two sites that are authoritative and two sites that are not authoritative. Explain your reasoning. Finally, write down the best site for finding out information about your favorite sport.

2. Search for information about an earth science topic of your choice on the Internet (for example: "earthquakes," "hurricanes," or "plate tectonics"). Find one source that you would NOT consider authoritative. Write the key words you used in your search, the web address of the source, and a sentence explaining why this source is not authoritative.

3. Find a different source that is authoritative, but intended for a much younger audience. Write the web address and a sentence describing who you think the intended audience is.

4. Find three sources that you would consider to be good choices for your research here. Write a two to three sentence description of each. Describe the author, the intended audience, the purpose of the site, and any special features not found in other sites.

Name: ______________________ Date: ______________

SKILL and PRACTICE 3.1

Bibliographies

READ

When you write a research paper or prepare a presentation for your class, it is important to document your sources. A bibliography serves two purposes. First, a bibliography gives credit to the authors who wrote the material you used to learn about your subject. Second, a bibliography provides your audience with sources they can use if they would like to learn more about your subject.

This skill sheet provides bibliography formats and examples for research materials you may use when preparing science papers and presentations

EXAMPLES

Books:

Author last name, First name. (Year published). *Title of book*. Place of publication: Name of publisher.

Vermeij, Geerat. (1997). *Privileged Hands: A Scientific Life*. New York: W.H. Freeman and Company.

Newspaper and Magazine Articles:

Author listed:

Author last name, First name. (Date of publication). Title of Article. *Title of Newspaper or Magazine*, page # or #'s.

Searcy, Dionne. (2006, March 20). Wireless Internet TV Is Launched in Oklahoma. *The Wall Street Journal*, p. B4.

Brody, Jane. (2006, February/March). 10 Kids' Nutrition Myth Busters. *Nick Jr Family Magazine*, pp. 72-73.

No author listed:

Title of article. (Date of publication). *Title of Newspaper or Magazine*, page # or #'s.

Chew on this: Gum may speed recovery. (2006, March 20). *St. Louis Post-Dispatch*, p.H2.

Adventures in Turning Trash into Treasure: (2006, April). *Reader's Digest*, p. 24.

Online Newspaper or Magazine:

Author listed:

Author last name, First name. (Date of publication). Title of Article. *Title of Newspaper or Magazine*, Retrieved date, from web address.

Dybas, Cheryl Lyn. (2006, March 20). Early Spring Disturbing Life on Northern Rivers. *The Washington Post*, Retrieved March 22, 2006, from www.washingtonpost.com.)

No author listed:

Title of Article. (Date of publication). *Title of Newspaper or Magazine*. Retrieved date, from web address.

Comet mystery turns from hot to cold. (2006, March 20). *The Boston Globe*, retrieved March 22, 2006, from Boston.com.

Online document:

Author listed:

Author last name, author first name. (Date of publication). *Title of document*. Retrieved date, from web address.

Martinez, Carolina. (2006, March 9). *NASA's Cassini Discovers Potential Liquid Water on Enceladus*. Retrieved March 22, 2006, from http://www.nasa.gov/mission_pages/cassini/media/cassini-20060309.html

No Author listed:

National Science Foundation. (2005, December 15). *A fish of a different color*. Retrieved March 22, 2206 from http://www.nsf.gov/news/news_summ.jsp?cntn_id=105661&org=NSF&from=news.

Name: ______________________ Date: ______________

SKILL and PRACTICE 3.2

Averaging

READ

The most common type of average is called the *mean*. Usually when someone (who's not your math teacher) asks you to find the average of something, it is the *mean* that they want. To find the mean, just sum (add) all the data, then divide the total by the number of items in the data set. This type of average is used daily by many people. Teachers and students use it to average grades. Meteorologists use it to average normal high and low temperatures for a certain date. Sports statisticians use it to calculate batting averages and many other things.

EXAMPLE

- William has had three tests so far in his English class. His grades are 80%, 75%, and 90%. What is his average test grade?

  Solution:

  a. Find the sum of the data: 80 + 75 + 90 = 245

  b. Divide the sum (245) by the number of items in the data set (3): $245 \div 3 \approx 82\%$

  William's average (mean) test grade in English (so far) is about 82%

PRACTICE

1. The families on Carvel Street were cleaning out their basements and garages to prepare for their annual garage sale. At 202 Carvel Street, they found seven old baseball gloves. At 208, they found two baseball gloves. At 214, they found four gloves, and at 221 they found two gloves. If these are the only houses on the street, what is the average number of old baseball gloves found at a house on Carvel Street?

2. During a holiday gift exchange, the members of the winter play cast set a limit of $10 per gift. The actual prices of each gift purchased were: $8.50, $10.29, $4.45, $12.79, $6.99, $9.29, $5.97, and $8.33. What was the average price of the gifts?

3. During weekend baby sitting jobs, each sitter charged a different hourly rate. Rachel charged $4.00, Juanita charged $3.50, Michael charged $4.25, Rosa charged $5.00, and Smith charged $3.00.

   a. What was the average hourly rate charged among these baby sitters?

   b. If they each worked a total of eight hours, what was their average pay for the weekend?

4. The boys on the sixth grade basketball team at Fillmore Middle School scored 22 points, 12 points, 8 points, 4 points, 4 points, 3 points, 2 points, 2 points, and 1 point in Thursday's game. What was the average number of points scored by each player in the game?

5. Jerry and his friends were eating pizza together on a Friday night. Jerry ate a whole pizza (12 slices) by himself! Pat ate three slices, Jack ate seven slices, Don and Dave ate four slices each, and Teri ate just two slices. What was the average number of slices of pizza eaten by one of these friends that night?

Name: ______________________________ Date: ______________

SKILL and PRACTICE 3.2

Understanding Math in Words

READ

Math and reading skills are important to understanding science. Throughout your study of science, you will be asked to solve math problems. This exercise will show how key words help you to understand the problem and give you a clue to solving it. You will gain practice reading and solving a variety of math word problems.

EXAMPLES

When you have a math problem, the first step is to find out what operation to perform. The following examples show you which operation is required. The key words in bold mean "do this operation."

- **Addition:** Sue has 5 blue beads and 4 red beads. How many beads does she have **all together**?
- **Subtraction:** John has $3. The toy cost $1.50. After he buys the toy, how much money does he have **left over**?
- **Multiplication:** The egg carton had 12 eggs. One sixth **of** the 12 eggs are gone. How many are gone?
- **Division:** The speed limit is 55 miles **per** hour. Traveling at the speed limit, how many hours did it take to travel 55 miles?

Math problems may be written in different ways. Here are more examples of phrases that tell which operation is needed.

Addition	Subtraction	Multiplication	Division
How many **all together**?	Find the number **left over**.	A fraction (or percent) **of** another number	A number **per** a unit
How many **in all**?	**Take away** one number from another.	a number **times** another number	a number **divided by** another number
Find the **sum**.	Which is **more**?	Find the **product** of two numbers.	the **ratio** of two numbers
What is the **total**?	How many **remain**?	The **discount** is 10% **off of** the original price.	a measurement **versus** another measurement
	Find the **difference**.	Find the **interest earned** on a dollar amount.	Find the **quotient and remainder**.
	How many **more are needed**?	A number **at a given rate** gives another number.	a number **out of** the total
			A divisor **goes into** a dividend how many times?

PRACTICE 1

Solve the problems in the examples above. Show your work.

1. Addition: ____

2. Subtraction: ____

3. Multiplication: ____

4. Division: ____

Now, rewrite the word problems using different phrases to mean “do this operation.” The problems should have the same answer as the original examples.

1. ____

2. ____

3. ____

4. ____

EXAMPLE

Fractions can be written in different ways. Sometimes they look like a number over another number, for example, $^{2}/_{5}$, or they can be written as percents, ratios, and proportions. The following examples will give you a chance to work with fractions and recognize them in different mathematical expressions.

Percent tells how many out of 100. The data below shows that 55% of students drink milk at school. That means 55 out of 100 students drink milk. The fraction is $^{55}/_{100}$. It also can be simplified to $^{11}/_{20}$.

PRACTICE 2

Fill in the missing percentages in Table 1 below. Then, answer the following questions to show you understand the concept of fractions and percent.

Table 1: Lunch drinks consumed by students at Fredrick Elementary School

Drink	Number of students	Percent
Whole milk	45	
Strawberry milk	10	10%
Orange juice	20	
Water	25	
Total	100	100%

Refer to Table 1 to answer these following questions.

1. Give the total number of students surveyed at Fredrick Elementary School.
2. What percentage of students drink whole milk?
3. Write a fraction for the number of students that drink orange juice out of the total number of students surveyed. (HINT: “Out of” means “divided by.”)
4. Put the fraction of students who drink strawberry milk in its simplest form.
5. Show how the author found that 55% of students drink milk.
6. If the survey was done with 200 students and the percentage of students drinking each drink stayed the same, what number of students out of 200 drink water? Show how you found your answer.

EXAMPLE

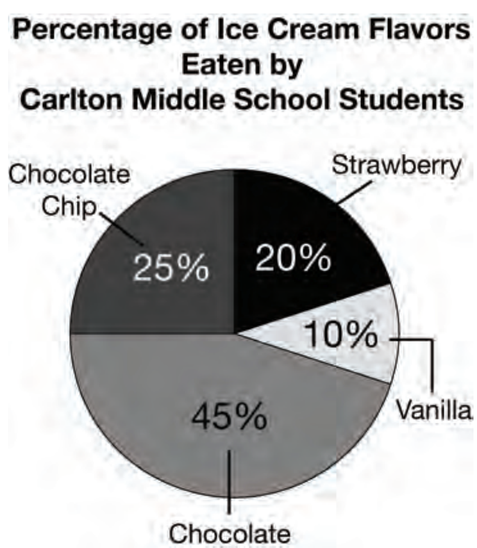
A ratio compares two numbers and can be written as a fraction. A ratio uses the wording, “the ratio of this to that.” When you write out the numbers as a fraction, be sure to write them in the correct order. The first number in a ratio is the numerator, and the second number is the denominator.

In the previous example, the ratio of the least popular drink, strawberry milk, to the most popular drink, whole milk, is 10 to 45. Ratios can be written as 10 to 45, 10:45, or $^{10}/_{45}$. Ratios can be simplified the same way fractions can. A proportion is an equation that shows two ratios are equal.

The ratio $^{10}/_{45} = {}^{2}/_{9}$. This is a proportion. When one of the numbers in the proportion is unknown, you can find the unknown value by using cross products.

PRACTICE 3

Pie graphs are a useful way of showing percentages for a set of data. Below is a pie graph. In the following exercise you will gain practice working with percentages and fractions for a set of data.



1. Fill in the missing percentages in the table below based on the information in the pie graph titled, "Percentage of Ice Cream Flavors Eaten by Carlton Middle School Students." You will need to solve for the number of students out of 1000 that ate each type of ice cream. Calculate the simplest fraction for each type of ice cream out of the total.

Table 2: Ice cream flavors eaten by students at Carlton Middle School

Ice cream flavor	Number of students	Percent	Fraction of students eating that type of ice cream
Chocolate			
Vanilla		25%	
Chocolate chip			
Strawberry			
Total	1000	100%	

2. What is the ratio of students eating chocolate ice cream to the total number of students eating ice cream?
3. What is the fraction of students eating chocolate ice cream out of the total number of students eating ice cream?
4. Do your answers for questions 2 and 3 agree? Explain.
5. List the number of students eating chocolate chip ice cream in the following four different ways:
   a. the number of students
   b. as a percentage of the total
   c. as a fraction of the total
   d. as a ratio of chocolate chip to vanilla

Name: ______________________________ Date: ______________

SKILL and PRACTICE 3.2

Heat Transfer

READ

Heat, as a form of energy, can be transferred from one object to another. Heat always moves from warmer objects to cooler objects. Conduction, convection, and radiation are different ways that heat transfer occurs in nature. Conduction is the transfer of heat by the direct contact of atoms and molecules in solids. Convection is the transfer of heat through the motion of gases and liquids such as air and water. Finally, radiation is heat transfer that involves energy waves and no direct contact or movement of atoms.

EXAMPLE

You are cooking dinner for your little brother and sister. You decide that you will make them spaghetti, which requires you to boil water. The diagram at right shows how the pot is heated, and how heat is transferred throughout the water in the pot in order to make the water boil. What type of heat transfer is this?

Solution: This is convection because it is the transfer of heat through the motion of a liquid.

PRACTICE

1. You are outside in your yard at noon time. You start to feel quite warm due to heat from the sun. What type of heat transfer is this? Explain how you know.
2. There is a snowstorm one night and your driveway has quite a bit of snow. You have to help your dad shovel the driveway. At one point you take your glove off and touch the metal shaft of the shovel, and your hand immediately feels cold. What type of heat transfer is this? Explain how you know.
3. Earth's mantle is made of liquid molten material. The inner part of the mantle is hotter than the outer part. Therefore, currents carry molten material up to Earth's surface. Then, they cool off so much that they sink back down into the warmer area. What type of heat transfer is this? Explain how you know.
4. When you are sitting on a beach in the late afternoon, there is generally a cool breeze that blows off of the ocean. This is called a sea breeze. The reason that a sea breeze builds up in the afternoon is because the sea is cooler than the land, and therefore wind currents are created. What type of heat transfer is this? Explain how you know.
5. John is sitting by a campfire at night with his friends. He feels a tremendous amount of warmth from the fire on this cool evening. What type of heat transfer is this? Explain how you know.
6. You order a hot chocolate at a nearby coffee shop. When you take your first sip, the hot chocolate is so hot that you burn your tongue. What type of heat transfer is this? Explain how you know.
7. Cold water in Earth's oceans sinks to the bottom of the ocean, while warm water in Earth's oceans rises to the surface of the ocean. This motion creates what scientists have called ocean currents. These ocean currents are caused by the transfer of heat. What type of heat transfer is this? Explain how you know.

Name: ______________________ Date: ______________

SKILL and PRACTICE 3.3

Density

Density is a physical property of matter. A *physical property* can be measured or viewed without making any changes to the material. Some physical properties, like mass, depend on how much matter is present. The density of a substance does not depend on how much matter is present.

Suppose you were given a solid gold bar and a gold ring. How do you think the density of the gold bar would compare to the density of the gold ring? As long as both the bar and ring are made entirely of gold, their densities are equal. The density of a material is always the same, even if its size or shape changes.

- The formula for density is: $\text{density} = \frac{\text{mass}}{\text{volume}}$
- One milliliter takes up the same amount of space as one cubic centimeter. Therefore, density can be expressed in units of g/mL or g/cm^3. Liquid volumes are most commonly expressed in milliliters, while volumes of solids are usually expressed in cubic centimeters.
- Density can also be expressed in units of kilograms per cubic meter (kg/m^3).

You can rearrange the density equation to find out the mass or volume of a substance.

Equation...	Gives you...	If you know...
$D = m/v$	density	mass and volume
$m = v \times D$	mass	volume and density
$v = m/D$	volume	mass and density

EXAMPLES ▶

- **Example 1:** What is the density of cork if a 1.5-gram sample has a volume equal to 6.25 cm^3?

  Solution:

$$\text{density} = \frac{m}{v} = \frac{1.5\text{ g}}{6.25\text{ cm}^3} = 0.24\text{ g/cm}^3$$

  The density of cork is 0.24 g/cm^3.

- **Example 2:** What is the volume of a lead block with a density of 11.3 g/cm^3 and a mass of 60.5 grams?

  Solution:

$$\text{volume} = \frac{m}{D} = \frac{60.5\text{ g}}{11.3\text{ g/cm}^3} = 5.35\text{ cm}^3$$

  The volume of the lead block is 5.35 cm^3.

PRACTICE

1. What is the mass of a sample of rubber if its density is 1.1 g/cm^3 and it has a volume of 6.0 cm^3?

2. Daniel found an oddly-shaped object while walking to school. He asked the science teacher to borrow a balance to find the mass of the object. Daniel determined the object's mass to be 4.55 grams. He then added 20.0 milliliters of water to a graduated cylinder and placed the object inside.
   a. After adding the object to the graduated cylinder, Daniel observed that the water level rose to 26.5 milliliters. What is the volume of the object?
   b. What is the density of the object?

3. What is the density of a substance if 1.50 cubic meters has a mass of 1.89 kilograms?

4. Use the data in the table below to answer questions 4a-e.

Material	Density (g/cm^3)
mercury	13.6
silver	10.5
water	1.00
iron	7.86
gold	19.3
platinum	21.4

   a. Jada read a story about a miner who lived during the time of the California "gold rush." The miner found a gold-colored nugget and passed it along to his grandson as a keepsake. The miner's grandson was curious about whether the nugget was really gold. He used a balance and found the mass of the nugget to be 12.1 grams. When placed in a graduated cylinder with water, the nugget caused the water level to increase by 2.42 milliliters. Was the nugget really gold? Explain your answer. (Hint: Remember 1 mL = 1 cm^3)
   b. What is the mass of a sample of mercury if its volume is 4.35 cubic centimeters?
   c. Suppose you had one cubic centimeter (1 cm^3) of each material listed in the table. Which material would have the greatest mass? Which would have the least mass?
   d. What is the volume of a 2.45 gram sample of iron?
   e. Christopher found a shiny coin on the playground. The coin had a mass of 18.9 grams. He placed the coin in a graduated cylinder filled with water to the 25.0-milliliter mark. The coin sank to the bottom of the cylinder and the water level rose to the 26.8-milliliter mark. Of what material was the coin made?

5. The density of ice is 0.920 g/cm^3. What is the mass of a block of ice with a volume equal to 16.0 cubic centimeters?

Name: ______________________ Date: ______________

Buoyancy

SKILL and PRACTICE 3.3

READ

When an object is placed in a fluid like water, the fluid pushes up on the object. This upward force is called a **buoyant force**. At the same time, there is an attractive force between the object and Earth, which we call the force of gravity. It acts as a *downward force.*

- If the buoyant force pushing up on an object is greater than the force of gravity pulling down on the object, then the object floats.
- If the buoyant force pushing up on an object is less than the force of gravity pulling down on an object, then the object sinks.

Suppose you completely fill a bucket with water. What happens if you place a brick in the bucket? The water will spill over the sides of the bucket. The brick *displaces* (or takes the place of) some of the water, which causes the water level in the bucket to rise.

An object placed in a fluid displaces a volume of the fluid. The volume of fluid displaced is equal to the volume of the object that sinks below the surface of the fluid. If the volume of a brick equals 500 cm^3, then the water pushed aside by the brick is 500 cm^3. On Earth, the 500 cm^3 volume of water displaced by the brick weighs 4.9 newtons. Because the water displaced by the brick weighs 4.9 newtons, the buoyant force acting on the brick is also 4.9 newtons. **The buoyant force acting on an object in a fluid is equal to the weight of the fluid the object displaces.**

Buoyancy is related to density. If you know the density of an object and the density of the fluid in which it is placed, you can predict whether it will sink or float. When an object is *less dense* than the fluid it is in, the object will **float**. An object that is *more dense* than the fluid it is in will **sink**.

Sometimes an object placed in a fluid neither sinks nor floats, but is suspended in the fluid. This occurs when the upward buoyant force is equal to the downward force of gravity and is called *neutral buoyancy.*

EXAMPLES

Example 1: A teacher places a golf ball in a beaker filled with water. If the density of the golf ball is 1.17 g/cm^3 and the density of water is 1.00 g/cm^3, will the golf ball sink or float? **Answer:** Sink. The golf ball is more dense than the water.

Example 2: Stuart bought a goldfish from the pet store. When placed in a bowl of water, the goldfish neither sank nor floated. What inference can Stuart make about the forces acting on the goldfish? **Answer:** Two forces are acting on the goldfish: buoyancy and gravity. The goldfish does not sink or float because the forces of buoyancy and gravity are equal but opposite of one another. The goldfish demonstrates neutral buoyancy.

Example 3: Jennifer placed 24.2 milliliters of water in a graduated cylinder. She carefully placed a rock in the cylinder, which caused the water level to rise to 26.7 milliliters. What volume of water is pushed aside by the rock? **Answer:** The volume of water pushed aside by the rock is equal to the rise in the water level within the graduated cylinder.

$$26.7 \text{ mL} - 24.2 \text{ mL} = 2.5 \text{ mL}$$

PRACTICE

1. A lead block placed in water sinks. If 875 cm^3 of water is pushed aside by the block, what is the volume of the block?
2. The density of a piece of wood is 0.9 g/cm^3. Will the piece of wood sink or float in water?
3. The same piece of wood is placed in mercury, which has a density of 13.6 g/cm^3. Will it sink or float?
4. Suppose a ball is placed in each of the fluids listed in the table below. If the density of the ball is 0.84 g/cm^3, in which fluids will it float? In which fluids will the ball sink?

Material	Density (g/cm^3)
gasoline	0.73
water	1.00
vegetable oil	0.89
kerosene	0.82
milk	1.03

5. A 3.24-gram object has a volume of 5.46 milliliters.
   a. What is the density of the object?
   b. Does the object sink or float in vegetable oil?
6. Carrie found a strange rectangular-shaped object in her backyard. She determined its mass to be 5.84 grams.
   a. Carrie used her ruler to measure the object. She recorded its length as 4.00 centimeters, its width as 2.00 centimeters, and its height as 1.00 centimeter. What is the volume of the object?
   b. What is the density of the object Carrie found?
   c. Carrie placed the object in water. Did it sink or float?
   d. Would this object sink or float in gasoline? Explain your answer.
7. An object has a volume of 1,550 cm^3.
   a. What volume of water is displaced by the object if you push it underwater?
   b. Suppose the object weighs 450 newtons. What is the buoyant force acting on the object?
8. The force of gravity acting on an object on Earth is 9.8 newtons. If the buoyant force acting on the object is 5.6 newtons, does the object sink or float? Explain your answer.
9. A cube placed in water neither sinks nor floats. What can you infer about the forces acting on the cube?
10. The density of paraffin wax is 0.87 g/cm^3. A student places a block paraffin wax in water. Will it sink or float?

Name: ______________________ Date: ______________

SKILL and PRACTICE 3.3

Mass vs. Weight

READ

What is the difference between mass and weight?

mass	weight
• Mass is a measure of the amount of matter in an object. Mass is not related to gravity. • The mass of an object does not change when it is moved from one place to another. • Mass is commonly measured in grams or kilograms.	• Weight is a measure of the gravitational force between two objects. • The weight of an object does change when the amount of gravitational force changes, as when an object is moved from Earth to the moon. • Weight is commonly measured in newtons or pounds.

Weightlessness: When a diver dives off of a 10-meter diving board, she is in free-fall. If the diver jumped off of the board with a scale attached to her feet, the scale would read zero even though she is under the influence of gravity. She is "weightless" because her feet have nothing to push against. Similarly, astronauts and everything inside a space shuttle seem to be weightless because they are in constant free fall. The space shuttle moves at high speed, therefore, its constant fall toward Earth results in an orbit around the planet.

EXAMPLES

- On Earth's surface, the force of gravity acting on one kilogram is 2.22 pounds. So, if an object has a mass of 3.63 kilograms, the force of gravity acting on that mass on *Earth* will be:

$$3.63 \text{ kg} \times \frac{2.22 \text{ pounds}}{\text{kg}} = 8.06 \text{ pounds}$$

- On the moon's surface, the force of gravity is about 0.370 pounds per kilogram. The same object, if it traveled to the moon, would have a mass of 3.63 kilograms, but her weight would be just 1.33 pounds.

$$3.63 \text{ kg} \times \frac{0.370 \text{ pounds}}{\text{kg}} = 1.33 \text{ pounds}$$

PRACTICE

1. What is the weight (in pounds) of a 7.0-kilogram bowling ball on Earth's surface?
2. What is the weight of a 7.0-kilogram bowling ball on the surface of the moon?
3. What is the mass of a 7.0-kilogram bowling ball on the surface of the moon?
4. Describe what would happen to the spring in a bathroom scale if you were on the moon when you stepped on it. How is this different from stepping on the scale on Earth?
5. Would a balance function correctly on the moon? Why or why not?
6. **Activity:** Take a bathroom scale into an elevator. Step on the scale.
   a. What happens to the reading on the scale as the elevator begins to move upward? to move downward?
   b. What happens to the reading on the scale when the elevator stops moving?
   c. Why does your weight appear to change, even though you never left Earth's gravity?